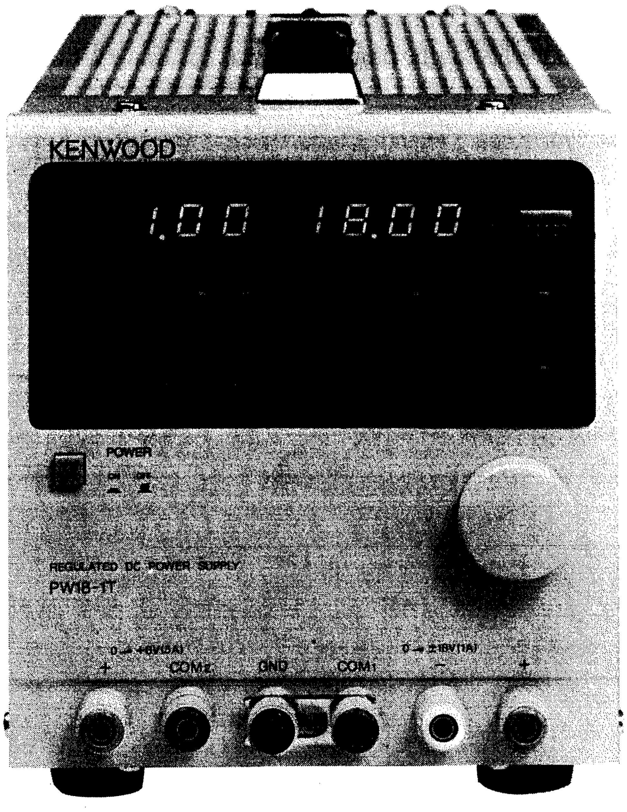
REGULATED DC POWER SUPPLY

PW18-1T

SERVICE MANUAL

KENWOOD CORPORATION


KENWOOD
1.00
18.00
POWER
REGULATED DC POWER SUPPLY
PW18-1T
+
COM2
GND
COM1
−
+

WARNING

The following instructions are for use by qualified personnel only. To avoid electric shock, do not perform any servicing other than contained in the operating instructions unless you are qualified to do so.

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SPECIFICATIONS

Model	PW18-1T	
OUTPUT VOLTAGE		
Output voltage	0 to +18V/0 to −18V	0 to +6V
Setting resolution	10mV	
Max. output voltage	+18V/−18V	+6.0V
Dual tracking	0 to ±18V	
Tracking deviation	±(1%+40mV) of rated voltage	
OUTPUT CURRENT		
Output current	0 to +1A/0 to −1A	0 to +5A
Setting resolution	10mA	
Max. output current	+1A/−1A	+5.0A
Dual tracking	0 to ±1A	
Tracking deviation	(2%+40mA) of rated current	
CONSTANT VOLTAGE CHARACTERISTICS		
Input fluctuation (for surge of AC±10%)	1mV	2mV
Load fluctuation (for surge of 0 to 100%)	2mV	5mV
Ripple/noise rms (10Hz to 1MHz)	0.5mV rms	
Ripple peak (p-p)	2.8mV p-p	5.6mV p-p
Transient response	50μs Typical	100μs Typical
Temperature coefficient	100ppm/°C Typical	
CONSTANT CURRENT CHARACTERISTICS		
Input fluctuation (for surge of AC±10%)	2mA Typical	4mA Typical
Load fluctuation (for surge of 0 to 100%)	10mA Typical	20mA Typical
Ripple/noise rms (10Hz to 1MHz)	2mA rms Typical	5mA rms Typical
Ripple peak (p-p)	5.6mA p-p Typical	10mA p-p Typical
Temperature coefficient	300ppm/°C Typical	
VOLTMETER		
Display (3-1/2 digit LED)	max. 19.99V, fixed range red LED	
Accuracy (output "ON")	±(0.5% rdg+2 digit) (23°C±5°C, less than 80% RH)	
AMPMETER		
Display (3 digit LED)	max. 9.99A, fixed range red LED	
±Accuracy (output "ON")	(1.0% rdg+2 digit) 23°C±5°C, less than 80% RH	
FUNCTIONS		
Output ON/OFF	ON/OFF switch. However, output cannot be ON when MEMORY ON. Red LED lights up when ON.	
Output protect ON/OFF	Disables the output of unexpected voltage and current in the output mode. This 'PROTECT' function becomes active when a different value is set by one of the PRESET, VARIABLE and TRACKING keys in the output mode. (ON→Red LED active)	
Preset (1,2,3)	3 voltages or currents can be preset as desired. Preset values can be easily checked. Green LED lights up when ON.	

SPECIFICATIONS

Model	PW18-1T
FUNCTIONS	
Memory	Several voltage and current presets can be stored. Red LED lights when ON.
Key Lock	Locks all functions as set. All controls except POWER are disabled. Red LED.
Delay	ON/OFF DELAY of ±18V and +6V output. Green LED lights up when ON.
V/A	Several voltages and currents can be set. Green LED.
Tracking and V/A display selection	±18V tracking, +18V, −18V, +6V
OUTPUT	
COM	±18V COM common, +6V single
Polarity	COM, positive or negative ground possible
Output terminals	+ (red), − (white), COM (blue), GND (black)
Ground proof voltage	±250V DC
SERIAL OUTPUT	0 to 36V +0 to 6V
OPERATION CONDITIONS	
Rated temperature/humidity range	0 to 40°C, 10 to 85% RH
Operation temperature/humidity range	0 to 40°C, 10 to 85% RH
Storage temperature/humidity range	−20 to 65°C, 10 to 85% RH
Cooling mechanism	Natural convection
POWER CONSUMPTION	
VA/W (at AC 100V)	approx. 210VA/176W
INPUT VOLTAGE	
Voltage, Frequency	AC 100V/120V/220V/240V±10% (max. 250V) 50/60Hz Internal switching possible.
DIMENSIONS AND WEIGHT	
Dimensions	width: 138mm height: 147mm depth: 372mm
Max. dimensions	width: 143mm height: 167mm depth: 392mm
Weight	approx. 8.2kg
Accessory items	1 instruction manual 1 power supply cord 2 fuses

■ Circuit and ratings are subject to change without notice due to developments in technology.

SAFETY

SAFETY

Before connecting the instrument to a power source, carefully read the following information, then verify that the proper power cord is used and the proper line fuse is installed for power source. If the power cord is not applied for specified voltage, there is always a certain amount of danger from electric shock.

Line voltage

This instrument operates using ac-power input voltages that 100/120/220/240 V at frequencies from 50 Hz to 60 Hz.

Power cord

The ground wire of the 3-wire ac power plug places the chassis and housing of the instrument at earth ground. Do not attempt to defeat the ground wire connection or float the instrument; to do so may pose a great safety hazard. The appropriate power cord is supplied by an option that is specified when the instrument is ordered.
The optional power cords are shown as follows in Fig. 1.

Line fuse

The fuse holder is located inside the instrument and contains the line fuse. Verify that the proper fuse is installed by replacing the line fuse.

Voltage conversion

This instrument may be operated from either a 100 V to 240 V, 50/60 Hz power source. Use the following procedure to change from 100 to 240 volt operation or vice versa.

1. Remove the case. Change the power voltage according to instruction manual.
2. Replace the fuse with a fuse of appropriate value, 2.5 amp for 100 VAC to 120 VAC operation, 1.5 amp for 220 VAC to 240 VAC operation.
3. When performing the reinsertion of fuse for the voltage conversion, the appropriate power cord should be used. (See Fig. 1.)

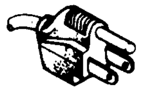
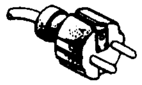
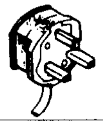
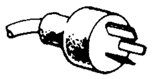
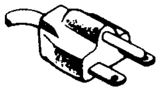
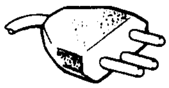
Plug configuration	Power cord and plug type	Factory installed instrument fuse	Line cord plug fuse	Parts No. for power cord set
	North American 120 volt/60 Hz Rated 15 amp (12 amp max; NEC)	2.5 A, 250 V Slow blow 6×30 mm	None	Cord: E30-1820-05
	Universal Europe 220 volt/50 Hz Rated 16 amp	1.5 A, 250 V Fast blow 6×30 mm	None	Cord: E30-1819-05
	U.K. 240 volt/50 Hz Rated 13 amp	1.5 A, 250 V Fast blow 6×30 mm	0.8 A Type C	–
	Australian 240 volt/50 Hz Rated 10 amp	1.5 A, 250 V Fast blow 6×30 mm	None	Cord: E30-1821-05
	North American 240 volt/60 Hz Rated 15 amp (12 amp max; NEC)	1.5 A, 250 V Fast blow 6×30 mm	None	–
	Switzerland 240 volt/50 Hz Rated 10 amp	1.5 A, 250 V Fast blow 6×30 mm	None	–

Fig. 1 Power Input Voltage Configuration

CIRCUIT DESCRIPTION

± 18 OUTPUT LINE

1. ± 12V AND + 5V GENERATOR

The ± 12V and + 5V AC voltages from the AC Power Transformer T1, are first transformed into DC power by a center-tap type control rectifier (D1) and (C1 and C2). The center tap of the transformer is used as the reference. A + 12V is then output through U2b and Q1 control circuits with the zener voltage (D4) as the reference voltage. The + 12V input into the U2 circuit becomes the output as a + 5V current, while that input into the U2a and Q2 control circuits becomes output as − 12V, with the center tap as the reference point of potential.

The resulting 12V and + 5V are used as the control power source of the 18 output and their reference of all center taps. The potentials are directly connected to the COM1.

2. RECTIFIER AND SMOOTHER (D21 AND C31)

AC Power output from T1 is transformed into DC power.

3. RECTIFIER AND SMOOTHER (D22 AND C32)

AC power output from T1 is transformed into DC power.

4. SERIES PASS TRANSISTORS (Q11 AND Q15)

Unstable DC power, output from D22 and C31, becomes stabilized. Transistor (Q11 and Q15) for NPN coupling are connected in series and regulated I signals output by amplifiers (Q3 and R45).

5. SERIES PASS TRANSISTORS (Q13 AND Q16)

Unstable DC power, output from D22 and C32, becomes stabilized. Transistors (Q13 and Q16) for PNP coupling are connected in parallel and controlled by signals output from amplifiers (Q4 and R46).

6. CURRENT DETECTOR (R57) AND VOLTAGE DIVIDER (VR3 AND R55)

Stable DC power output from Q11 and Q15 is led to the Power ON/OFF [k102 (1/2)] Switch via R57. The electric current input into R57 becomes output as voltage. This voltage input through VR3 and R55 becomes potential divided and in turn input into the Error Current Amplifier (U10a).

7. CURRENT DETECTOR (R58) AND VOLTAGE DIVIDER (VR4 AND R56)

Stable DC power output from Q13 and Q16 is led to the Power ON/OFF [k102 (2/2)] Switch via R58. The electric current input into R58 becomes output as voltage. This voltage input through VR4 and R56 becomes potential divided and in turn input into the Error Current Amplifier (U11a).

8. POWER ON/OFF [K102 (1/2) AND K102 (2/2)] SWITCHES AND POWER ON/OFF DRIVE (Q101)

Each ± DC power voltage, output from R57 and R58, passes through the Power ON/OFF Switch (K102) and in turn output from the Power Source__ Output Terminal. K102 (1/2) outputs positive power while K102 (2/2) outputs negative power. K102 (1/2) and K102 (2/2) each use two units of relays and the ON/OFF of ± the output is done simultaneously.

K102 is controlled by the Power Output ON/OFF Drive (Q101). K102 is ON when Q101 is ON and power is output. When Q101 is OFF, K102 is OFF and no power is output.

9. POWER OUTPUT DETECTION SWITCHES [K101 (1/2 AND 2/2)], POWER OUTPUT DETECTION DRIVE (Q103), AND SIGNAL DELAY (U102, D110, R124 AND C124)

For power output adjustment, positive voltage is input into K101 (1/2) and negative voltage is input into K101 (2/2). Output is made to each corresponding voltage driver. Both K101 (1/2) and K101 (2/2) constitute transfer relays and each one side is connected to the output side of K102 while each other side is connected to the opposite side, i.e opposite the output side of K102. Both K101 (1/2) and K101 (2/2) consist of 2 relay units and adjustment of the power output detection location is done simultaneously. When power is output through the main power source, potential detection is made on the sides of K101 (1/2) and K101 (2/2) which are on the output sides of K102. When there is no power output, power detection is made on the sides which are opposite the K102 output. K101 is controlled by the Power Output Detection Drive (Q102). When Q102 is ON, both K101 (1/2) and (2/2) become connected to each output side. When Q102 is OFF, the same become connected to the side opposite the output side.

Q102 is controlled by the signals from the Signal Delay (U102, D110, R124, and C124).The signals which turn Q101 to ON/OFF are buffered and sent as signals which turn Q102 to ON/OFF. Signals sent to Q102, versus those sent to Q102 ON/OFF. Signals sent to Q102, versus those sent to Q101, become delayed when Q102 is ON.

10.VOLTAGE DIVIDERS (R35 AND R36) (R37 AND R38)

The electrical potentials output from K101 (1/2) and K101 (2/2) are divided by voltage dividers R35 - R36 and R37 - R38. The divided potentials are then input into the Positive/Negative Detector Selector.

CIRCUIT DESCRIPTION

11. VOLTAGE DIVIDER (R28)

R28 is the complex resistor of 2k and 1k. The electrical potentials of K101 (1/2) are output to the 10k resistor, while the electrical potentials of reference voltage generator V (U10b,U15,R51,C19,C30) are output to the 2k resistor. Furthermore, the electrical potentials of COM of the 2k and 10k resistors are output to the error voltage amplifier (U12b).

12. VOLTAGE DIVIDER (R30)

R30 is the complex resistor of 2k and 10k. The electrical potentials of K101 (2/2) are output to the 10k resistor, while the electrical potentials of reference voltage generator V (U11b,U16,R53,C21,C29) are output to the 2k resistor. Furthermore, the electrical potentials of COM of the 2k and 10k resistors are output to the error voltage amplifier (U12a).

13. ERROR CURRENT AMPLIFIER (U10a)

The electrical potentials output from the Voltage Dividers (VR3 and R55) and those output from Reference Voltage Generator A (R52 and C20) are compared and their errors amplified. They are then input into the Signal Selectors (D8 and D9).

14. ERROR CURRENT AMPLIFIER (U11a)

The electrical potentials output from the Voltage Dividers (VR4 and R56) and those output from the Reference Voltage Generator A (R54 and C22) are compared and their errors amplified. They are then input into Signal Selectors (D10 and D11).

15. ERROR VOLTAGE AMPLIFIER (U12b)

The electrical potentials output from the Voltage Divider (R28) and those output from COM are compared and their errors amplified. They are then input into Signal Selectors (D8 and D9).

16. ERROR VOLTAGE AMPLIFIER (U13a)

The electrical potentials output from the Voltage Divider (R30) and those output from Reference Voltage Generator A (U11b) are compared and their errors amplified. They are then input into Signal Selectors (D10 and D11).

17. SIGNAL SELECTORS (D8 AND D9) AND SIGNAL AMPLIFIERS (Q3 AND R45)

D8 and D9 constitute cathode commons. Signals, either output from U10a or U12b , are selected depending on their potential condition and in turn input into signal amplifiers (Q3 and R45). Q3 versus Q11,Q12, and Q15 are Darlington-connected in two layers.

18. SIGNAL SELECTORS (D10 AND D11) AND SIGNAL AMPLIFIERS (Q4 AND R46)

D10 and D11 constitute encode commons. Signals, either output from U11a or U13a, are selected depending on their potential condition and in turn input into signal amplifiers (Q4 and R46). Q4 versus Q13, Q14, and Q16 are Darlington-connected in two layers.

19. COMPARISON VOLTAGE GENERATORS (R39 - R41)

The reference voltage is generated from 12V for establishing whether the main power source ± power output is CV or CC. Potentials for positive power output are negative and are input into Comparator (U12a), While those for the negative power output are positive and are input into Comparator (U13b).

20. COMPARATORS (U12a AND U13b)

A comparison is made between signals from the Error Current Amplifiers and the Comparison Voltage Generator to establish whether the main power source + power output is CV or CC. The condition of the power output is determined and the corresponding signal is input into the CPU.

21. REFERENCE VOLTAGE GENERATOR V (U10b, U15, R51, C19 AND C30)

The reference voltage for the positive power output is generated by U15, R51, C19 and C30, and led through the buffer constituting U10 b, and output as reference voltage. The voltage is normally a negative potential.

22. REFERENCE VOLTAGE GENERATOR V (U11b, U16, R53, C21 AND C29)

The reference voltage for the positive power output is generated by U16, R53, C21 and C29, and led through the buffer constituting U11 b, and output as the reference voltage. The voltage is normally a positive potential.

23. REFERENCE VOLTAGE GENERATOR A (R52 AND C20)

The reference voltage for the positive output current is generated by R52 and C20. The voltage is normally a negative potential.

24. REFERENCE VOLTAGE GENERATOR A (R54 AND C22)

The reference voltage for the negative output current is generated by R54 and C22. The voltage is normally a positive potential.

25. + V TIMING (U17b) AND − V TIMING (U17c) GENERATORS

These constitute 3 input AND circuits. Each U15 and U16 functions in a conducting condition in case the positive/negative voltage in Reference Voltage Generator V is reset. With the exception of the above case, a non-conducting condition is maintained and the positive/negative voltage generating capacity of Reference Voltage Generator V is increased.

CIRCUIT DESCRIPTION

26.DETECTOR VOLTAGE SELECTOR [U8 (Y)]

The detector voltage of each positive and negative voltage and 1 potential,out of the 4 current potentials, are selected and output into the following Reference Voltage Selectors. This selector, controlled by 3 digital signals (D17, D19 and D20), becomes non-conductive when selection is being carried out.

D17	D19	D20	Conductivity & selected potential
H	—	—	Non-conductive
L	L	L	Positive detector voltage value
L	H	L	Positive detector current value
L	L	H	Negative detector voltage value
L	H	H	Negative detector current value

27.DETECTOR VOLTAGE SELECTOR [U7 (Z)]

Either the potential selected by [U8 (Y)] or the COM potential is selected and output to the Comparator. This selector is controlled by 1 digital signal (D16).

D16	Selected potential
L	[U8 (Y)] potential
H	COM potential

28. ± REFERENCE VOLTAGE GENERATOR DAC (U6, U9, D7, R17 - R22, R69 - R71 AND VR1 - VR2)

All reference voltages for the power source are generated here. U6 constitutes a 12 bit current adding type DAC. Current - to - voltage conversion is carried out in U19a and U19b,while negative potentials are generated in U19b. The digital signals used in DAC are D1 - D12. This DAC, however, can be used as a 14 bit DAC by simply adding 2 bits, digital signals D23 - D24 and through R69 - R71, on the LSB side. The reference voltage for AMP U9a and U9b, used for ± voltage - voltage conversion, becomes generated by D7 and in R19 - R22.

Input digital signal	000H	3FFFH
Generated + Voltage TYP value	− 186 mV	+ 3.910 V
Generated − Voltage TYP value	+ 186 mV	− 3.920 V

29. ± REFERENCE VOLTAGE SWITCH [U7 (X)]

Either the ± reference voltage output from U9a or that output from U9b is selected and input into the following Reference Voltage Switch [U7 (X)].
This switch is controlled by 1 digital signal (D14)

D14	Selected potential
L	Positive reference voltage
H	Negative reference voltage

30.REFERENCE VOLTAGE SWITCH [U7 (Y)]

A signal from [U7 (X)] is input either the comparator or the next Reference Voltage SWitch [U8 (X)] depending on the selection made.
This switch is controlled by 1 digital signal (D15).

D15	Where signal is sent
L	Comparator
H	U8 (X).

31.REFERENCE VOLTAGE SWITCH [U8 (X)]

A signal from [U7 (Y)] is input either to the four ± Reference Voltage Generators V or to Reference Voltage Generator A.

The signal that controls this switch is the same signal that controls the Reference Voltage Selector [U8 (Y)].

D17	D19	D20	Conducting condition & where signal is sent
H	—	—	Non-conducting condition
L	L	L	Positive Reference Voltage Generator V
L	H	L	Positive Reference Voltage Generator A
L	L	H	Negative Reference Voltage Generator V
L	H	H	Negative Reference Voltage Generator A

32.COMPARATOR (U14)

A comparison is made on the potentials of signals sent from [U7 (Y)] and [U7 (Z)] . Data decided from the comparison is then sent to the CPU via the Signal Converter. Overall speaking, data is output following successive comparison.

Contents of decided data	Signal from [U7 (Y)]	Signal from [U7 (Z)]
Detection of positive reference voltage 0V data	Positive reference	voltage COM
Detection of negative reference voltage 0V data	Negative reference	voltage COM
Detection of positive output voltage values	Positive reference	voltageVoltage Divider (R35 and R36)
Detection of negative output voltage values	Negative reference	voltage Voltage Divider (R37 and R38)
Detection of positive output current values	Negative reference	voltage Voltage Divider (VR3 and R55)
Detection of negative output current values	Positive reference	voltage Voltage Divider (VR4 and R56)

In order to minimize offset error in U14a, U14b is used as a buffer and offset error is overall canceled in U4.

33.SIGNAL CONVERTER (U17a, D18, R59 - R63)

The ± 12V signals sent from U14 are converted to ± 5V signals in D18 and R59 - R60. These signals get a 0.25V hysteresis, with 2.5V as the center, by U17a, R61 and R62. They are then sent to the CPU.

34.DATA LATCH (U3 - U5)

The 24 bit data sent to the serial from the CPU are serial parallel converted and output as 24 bit data.

CIRCUIT DESCRIPTION

+ 6 OUTPUT LINE

1. ± 12V AND + 5V GENERATOR

The ± 12V and + 5V AC voltages from the AC Power Transformer T1, are first transformed into DC power by a center-tap type control rectifier (D1) and (C1 and C2). The center tap of the transformer is used as the reference. A + 12V is then output through U2b and Q1 control circuits with the zener voltage (D4) as the reference voltage. The + 12V input into the U2 circuit becomes the output as a + 5V current, while that input into the U2a and Q2 control circuits becomes output as -12V, with the center tap as the reference point of potential.

The resulting 12V and + 5V are used as the control power source and their reference of all center taps. The potentials are directly connected to the COM2.

2. RECTIFIER AND SMOOTHER (D25 AND C31)

AC power output from T1 is transformed into DC power.

3. SERIES PASS TRANSISTORS (Q11 - Q14)

Unstable DC power, output from D22 and C32, becomes stabilized. Transistors (Q11-Q14) for PNP coupling are connected in parallel and controlled by signals output from amplifiers (Q4 and R46).

4. CURRENT DETECTOR (R57, R58 AND R186) AND VOLTAGE DIVIDER (VR4 AND R56)

Stable DC power output from Q13 and Q16 is led to the Power ON/OFF [k104] Switch via R57, R58 and R186. The electric current input into R57,R58 and R186 becomes output as voltage. This voltage input through VR4 and R56 becomes potential divided and in turn input into the Error Current Amplifier(U11a).

5. POWER ON/OFF [K104] SWITCHES AND POWER ON/OFF DRIVE (Q102)

The DC power voltage, output from R57, R58 and R186, passes through the Power ON/OFF Switch(K104) and in turn output from the Power Source 8 Output Terminal. K104 output power.

K104 is controlled by the Power Output ON/OFF Drive (Q102). K104 is ON when Q102 is ON and power is output. When Q102 is OFF, K104 is OFF and no power is output.

6. POWER OUTPUT DETECTION SWITCHES [K103(2/2)], POWER OUTPUT DETECTION DRIVE (Q104), AND SIGNAL DELAY (U102, D111, R126 AND C123)

For power output adjustment, + 8 voltage is input. K103(2/2) is sent to corresponding voltage divider. One side is connected to the output side of K104 while each other side is connected to the opposite side, i.e opposite the output side of K104. When power is output through the + 8 power source, potential detection is made on the K104 which are on the output side of K104. When there is no power output, power detection is made on the sides which are opposite the K104 output. K103(2/2) is controlled by the Power Output Detection Drive (Q104). When Q102 is ON, both K101 (1/2) and (2/2) become connected to each output side. When Q102 is OFF, the same become connected to the side opposite the output side.

Q104 is controlled by the signals from the Signal Delay (U102, D111, R126 and C123).The signals which turn Q102 to ON/OFF are buffered and sent as signals which turn Q104 to ON/OFF. Signals sent to Q104, versus those sent to Q104 ON/OFF. Signals sent to Q104, versus those sent to Q102, become delayed when Q104 is ON.

7. VOLTAGE DIVIDERS (R35 AND R36) (R37 AND R38)

The electrical potential output from K103(2/2) are divided by voltage dividers R37 and R38. The divided potentials are then input into the Voltage Detector Switch.

8. VOLTAGE DIVIDER (R30)

R30 is the complex resistor of 2k and 10k. the electrical potentials of k101(2/2) are output to the 10k resistor, while the electrical potentials of reference voltage generator V (U11b, U16, R53, C21, C29) are output to the 2k resistor. Furthermore, the electrical potentials of COM of the 2k and 10k resistors are output to the error voltage amplifier(U12a).

9. ERROR CURRENT AMPLIFIER (U11a)

The electrical potentials output from the Voltage Dividers (VR4 and R56) and those output from the Reference Voltage Generator A (R54 and C22) are compared and their errors amplified. They are then input into Signal Selectors(D10 and D11).

10.ERROR VOLTAGE AMPLIFIER (U13a)

The electrical potentials output from the Voltage Dividers (R30) and those output from Reference Voltage Generator A (U11b) are compared and their errors amplified. They are then input into Signal Selectors (D10 and D11).

11.SIGNAL SELECTORS (D10 AND D11) AND SIGNAL AMPLIFIERS (Q4 AND R46)

D10 and D11 constitute encode commons. Signals, either output from U11a or U13a, are selected depending on their potential condition and in turn input into signal amplifiers (Q4 and R46). Q4 versus Q13, Q14, and Q16 are Darlington-connected in two layers.

CIRCUIT DESCRIPTION

12.COMPARISON VOLTAGE GENERATORS (R39 - R41)

The reference voltage is generated from 12V for establishing whether the main power source ± power output is CV or CC. While those for the + 6 power output are positive and are input into Comparator (U13b).

13.COMPARATOR (U13b)

A comparison is made between signals from the Error Current Amplifiers and the Comparison Voltage Generator to establish whether the main power source + power output is CV or CC. The condition of the power output is determined and the corresponding signal is input into the CPU.

14.REFERENCE VOLTAGE GENERATOR V (U11b, U16, R53, C21, AND C29)

The reference voltage for the positive power output is generated by U16, R53, C21, and C29, and led through the buffer constituting U11 b, and output as the reference voltage. The voltage is normally a positive potential.

15.REFERENCE VOLTAGE GENERATOR A (R54 AND C22)

The reference voltage for the negative output current is generated by R54 and C22. The voltage is normally a positive potential.

16.V TIMING (U17c) GENERATORS

These constitute 3 input AND circuits. U16 functions in a conducting condition in case the + 6 voltage in Reference Voltage Generator V is reset. With the exception of the above case, a non-conducting condition is maintained and the + 6 voltage generating capacity of Reference Voltage Generator V is increased.

17.REFERENCE VOLTAGE SELECTOR [U8 (Y)]

The reference voltage of each positive and negative voltage and 1 potential,out of the 4 current potentials, are selected and output into the following Reference Voltage Selectors. This selector, controlled by 3 digital signals (D18, D19, and D20), becomes non-conductive when selection is being carried out.

D18	D19	D20	Conductivity & selected potential
H	—	—	Non-conductive
L	L	L	
L	H	L	
L	L	H	+ 6 reference voltage value
L	H	H	+ 6 reference current value

18.REFERENCE VOLTAGE SELECTOR [U7 (Z)]

Either the potential selected by [U8 (Y)] or the COM potential is selected and output to the Comparator. This selector is controlled by 1 digital signal (D16).

D16	Selected potential
L	[U8 (Y)] potential
H	COM potential

19. ± REFERENCE VOLTAGE GENERATOR DAC (U6, U9, D7, R17 - R22, R69 - R71 AND VR1 - VR2)

All reference voltages for the power source are generated here. U6 constitutes a 12 bit current adding type DAC. Current - to - voltage conversion is carried out in U19a and U19b,while negative potentials are generated in U19b. The digital signals used in DAC are D1 - D12. This DAC, however, can be used as a 14 bit DAC by simply adding 2 bits, digital signals D23 - D24 and through R69 - R71, on the LSB side. The reference voltage for AMP U9a and U9b, used for ± voltage - voltage conversion, becomes generated by D7 and in R19 - R22.

Input digital signal	000H	3FFFH
Generated + Voltage TYP value	− 186 mV	+3.910 V
Generated − Voltage TYP value	+186 mV	−3.920 V

20. ± REFERENCE VOLTAGE SWITCH [U7 (X)]

Either the ± reference voltage output from U9a or that output from U9b is selected and input into the following Reference Voltage Switch [U7 (X)].

This switch is controlled by 1 digital signal (D14)

D14	Selected potential
L	Positive reference voltage
H	Negative reference voltage

21.REFERENCE VOLTAGE SWITCH [U7 (Y)]

A signal from [U7 (X)] is input either the comparator or the next Reference Voltage SWitch [U8 (X)] depending on the selection made.

This switch is controlled by 1 digital signal (D15).

D15	Where signal is sent
L	Comparator
H	U8 (X)

CIRCUIT DESCRIPTION

22.REFERENCE VOLTAGE SWITCH [U8 (X)]

A signal from [U7 (Y)] is input either to the four ± Reference Voltage Generators V or to Reference Voltage Generator A.

The signal that controls this switch is the same signal that controls the Reference Voltage Selector [U8 (Y)].

D18	D19	D20	Conducting condition & where signal is sent
H	—	—	Non-conducting condition
L	L	L	
L	H	L	
L	L	H	+ 6 Reference Voltage Generator V
L	H	H	+ 6 Reference Voltage Generator A

23.COMPARATOR (U14)

A comparison is made on the potentials of signals sent from [U7 (Y)] and [U7 (Z)]. Data decided from the comparison is then sent to the CPU via the Signal Converter. Overall speaking, data is output following successive comparison.

Contents of decided data	Signal from [U7 (Y)]	Signal from [U7 (Z)]
Detection of positive reference voltage 0V data	Positive reference voltage	COM
Detection of negative reference voltage 0V data	Negative reference voltage	COM
Detection of + 6 output voltage values	Negative reference voltage	Voltage Divider (R37 and R38)
Detection of + 6 output current values	Positive reference voltage	Voltage Divider (VR4 and R56)

In order to minimize offset error in U14a, U14b is used as a buffer and offset error is overall canceled in U4.

24.SIGNAL CONVERTER (U17a, D18, R59 - R63)

The ± 12V signals sent from U14 are converted to ± 5V signals in D18 and R59 - R60. These signals get a 0.25V hysteresis, with 2.5V as the center, by U17a, R61, and R62. They are then sent to the CPU.

25.DATA LATCH (U3 - U5)

The 24 bit data sent to the serial from the CPU are serial parallel converted and output as 24 bit data.

26.ISOLATOR AND +5V GENERATOR

The CPU and the AMP are electrically isolated and signals between them are transmitted using photo couplers in U103 - U105.

The power source on the CPU side is +5V generated in D101, C101 and U101.

27.NOISE SUPPRESSOR

In an effort to prevent noise, the CPU and Panel are equipped inside with a shielded case. There is some noise, however, that passes through the line of signal transmission between the CPU and Isolator. Such line noise is removed by the application of through type condensers, a total of 12, including that for the power source line.

CIRCUIT DESCRIPTION

CPU SECTION

1. CPU

The microcomputer uses a Z80 chip and has a clock speed of 4 MHz. A watch dog timer (U5 and C5) is used to prevent any run away (speeding) by the computer.

2. KEYBOARD INPUT, ROTARY ENCODER INPUT, INPUT PORT, AND INTERRUPT

When any of the keys (S51 - S63) are , pressed, the output of U55 becomes "L" and the CPU is interrupted. The pressed key becomes decided by signals (2 lines) from Output Port U53 and from Input Port U54. When the rotary encoder is operated, the collector potential of either Q62 or Q63 becomes "L", i.e. passing through the sequence U57e --» U57f --» U56, and this potential interrupts the CPU. The Rotary Encoder counts within a given time pass through U57a and U57b, and is input into the CPU via Input Port U7. As for the up/down decision of the encoder, data sent to the CPU via Input Port U7 is decided. This is because the Q output of U56a and U56b falls to "L", when data from the encoder first interrupts the CPU, and this state is maintained. Besides data from the keyboard or the rotary encoder, 3 types of data from the AMP and isolator are input into the Input Port U7 and U10. These data are different from those for the previously mentioned interrupt input. They are periodically read out by the CPU within the program loop, reaching the CPU via the Input Port U7 and U10.
Details of the said data are as a following:
(1) Comparative U14 data (Successive comparison data)
(2) Positive output data (CC state at "L")
(3) Negative output data (CC state at "L")

3. OUTPUT PORT

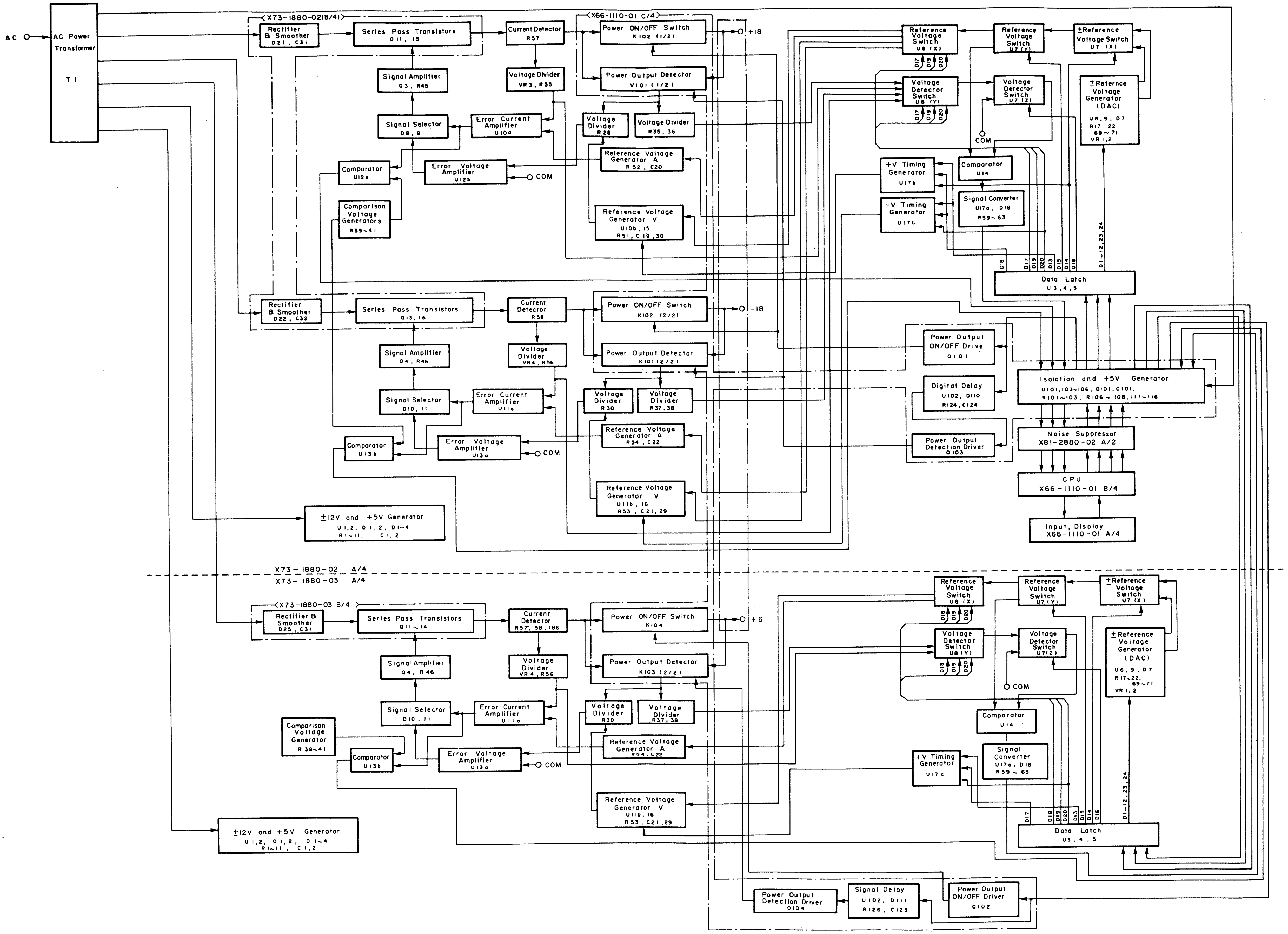
- The 2 pieces of data at Output Port U53 are normally "H". As previously mentioned, pressing any key (S51 - S63) turns either of the above data to "L" while the other remains "H". After data of the opposite nature is output, the key input becomes a decided.
- 5 pieces of data at Output Port U53 are used as control signals for the Display Drive.
- 3 pieces of data are sent to the AMP digital data generator from Output Port U53 via the Isolator.

The above data are as the following :
(1) 24 bit serial data
(2) 24 bit serial data shift clock data
(3) 24 bit serial data latch clock data
Data of above (2) are digital delayed through U1a, U1d, R136, C62, and D3. They are then sent to the digital data generator via the isolator. This action also compensates for any lag in the response time of the isolator's photo coupler.

4. DISPLAY DRIVE AND DISPLAY

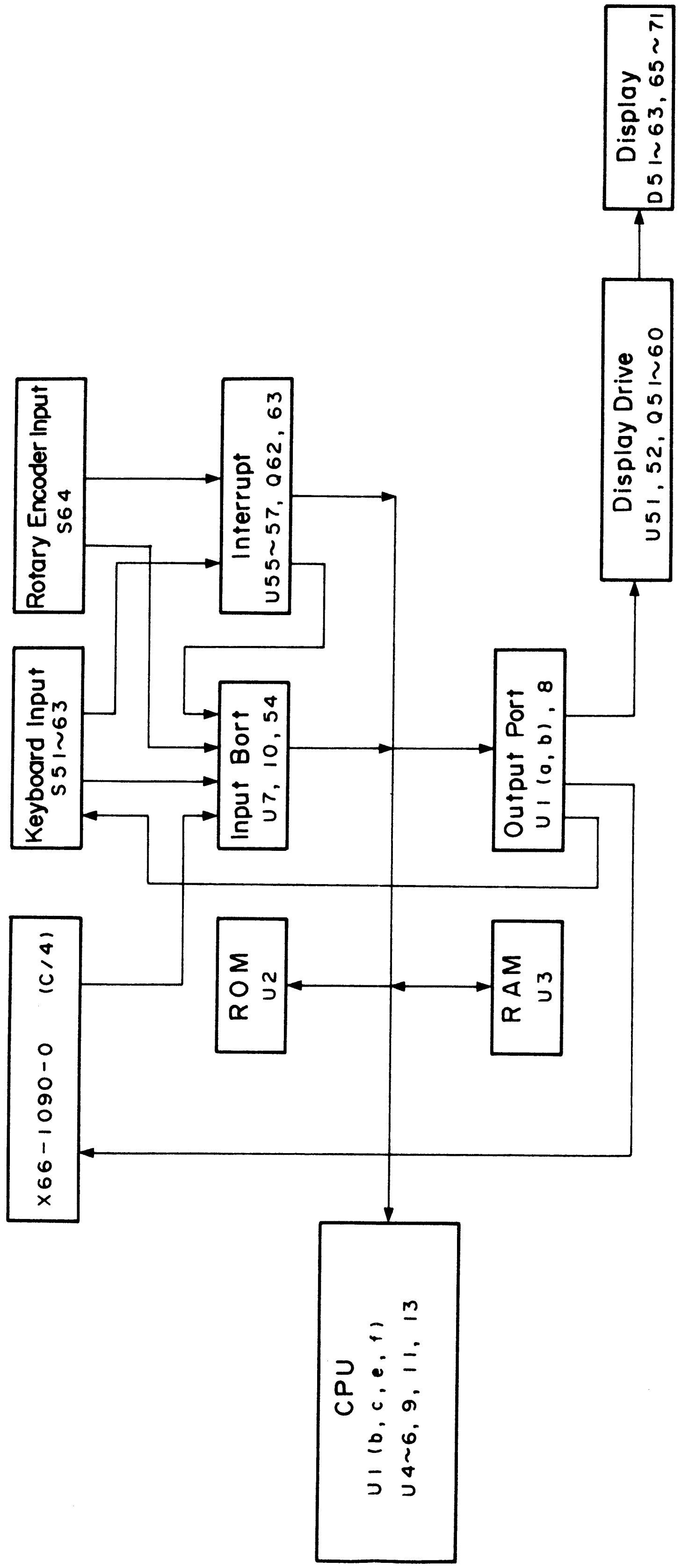
Both U51 and U52 are ICs for dynamic blinking lights. Transmitters (R83 and C60, R84 and C61, respectively) are equipped. The display is controlled by the previously mentioned 4 pieces of data from U53.

BLOCK DIAGRAM



AC
AC Power Transformer
T1
X73-1880-02(B/4)
Rectifier & Smoother
D21, C31
Series Pass Transistors
Q11, 15
Current Detector
R57
X66-1110-01 C/4
Power ON/OFF Switch
K102 (1/2)
+18
Signal Amplifier
Q3, R45
Voltage Divider
VR3, R55
Power Output Detector
V101 (1/2)
Signal Selector
D8, 9
Error Current Amplifier
U10a
Voltage Divider
R28
Voltage Divider
R35, 36
Comparator
U12a
Error Voltage Amplifier
U12b
COM
Reference Voltage Generator A
R52, C20
Comparison Voltage Generators
R39~41
Reference Voltage Generator V
U10b, 15
R51, C19, 30
Reference Voltage Switch
U8 (X)
D17 D19 D20
Reference Voltage Switch
U7 (Y)
±Reference Voltage Switch
U7 (X)
Voltage Detector Switch
U8 (Y)
D17 D19 D20
Voltage Detector Switch
U7 (Z)
±Reference Voltage Generator (DAC)
U6, 9, D7
R17 22
69~71
VR1, 2
COM
+V Timing Generator
U17b
Comparator
U14
−V Timing Generator
U17c
Signal Converter
U17a, D18
R59~63
D18 D17 D19 D20 D13 D15 D14 D16
D1~12, 23, 24
Data Latch
U3, 4, 5
Rectifier & Smoother
D22, C32
Series Pass Transistors
Q13, 16
Current Detector
R58
Power ON/OFF Switch
K102 (2/2)
−18
Signal Amplifier
Q4, R46
Voltage Divider
VR4, R56
Power Output Detector
K101 (2/2)
Power Output ON/OFF Drive
Q101
Signal Selector
D10, 11
Error Current Amplifier
U11a
Voltage Divider
R30
Voltage Divider
R37, 38
Digital Delay
U102, D110
R124, C124
Isolation and +5V Generator
U101, 103~106, D101, C101,
R101~103, R106~108, 111~116
Comparator
U13b
Error Voltage Amplifier
U13a
COM
Reference Voltage Generator A
R54, C22
Power Output Detection Driver
Q103
Noise Suppressor
X81-2880-02 A/2
CPU
X66-1110-01 B/4
Reference Voltage Generator V
U11b, 16
R53, C21, 29
Input, Display
X66-1110-01 A/4
±12V and +5V Generator
U1, 2, Q1, 2, D1~4
R1~11, C1, 2
X73-1880-02 A/4
X73-1880-03 A/4
X73-1880-03 B/4
Rectifier & Smoother
D25, C31
Series Pass Transistors
Q11~14
Current Detector
R57, 58, 186
Power ON/OFF Switch
K104
+6
Reference Voltage Switch
U8 (X)
D18 D19 D20
Reference Voltage Switch
U7 (Y)
±Reference Voltage Switch
U7 (X)
Voltage Detector Switch
U8 (Y)
D18 D19 D20
Voltage Detector Switch
U7 (Z)
±Reference Voltage Generator (DAC)
U6, 9, D7
R17~22,
69~71
VR1, 2
COM
Signal Amplifier
Q4, R46
Voltage Divider
VR4, R56
Power Output Detector
K103 (2/2)
Signal Selector
D10, 11
Error Current Amplifier
U11a
Voltage Divider
R30
Voltage Divider
R37, 38
Comparator
U14
Comparison Voltage Generator
R39~41
Comparator
U13b
Error Voltage Amplifier
U13a
COM
Reference Voltage Generator A
R54, C22
+V Timing Generator
U17c
Signal Converter
U17a, D18
R59~63
D1~12, 23, 24
D17 D18 D19 D20 D13 D15 D14 D16
Reference Voltage Generator V
U11b, 16
R53, C21, 29
Data Latch
U3, 4, 5
±12V and +5V Generator
U1, 2, Q1, 2, D1~4
R1~11, C1, 2
Power Output Detection Driver
Q104
Signal Delay
U102, D111
R126, C123
Power Output ON/OFF Driver
Q102

BLOCK DIAGRAM



ADJUSTMENT

To obtain the best performance, periodically calibrate the unit. Sometimes, only one mode need be calibrated, while at other times, all modes should be calibrated. When one mode is calibrated, it must be noted that the other modes may be affected. When calibrating all modes, perform the calibration in the specified sequence.

The following calibration required an accurate measuring instrument and an insulated adjusting flat blade screwdriver. If they are not available, contact your dealer. For optimum adjustment, turn the power on and warm up the scope sufficiently (more than 30 minutes) before starting.

Before calibrating the unit, check the power supply voltage.

TEST EQUIPMENT REQUIRED

The following instrument or their equivalent should be used for making adjustment.

Multimeter	45	FLUKE
Oscilloscope	CS-4025	KENWOOD

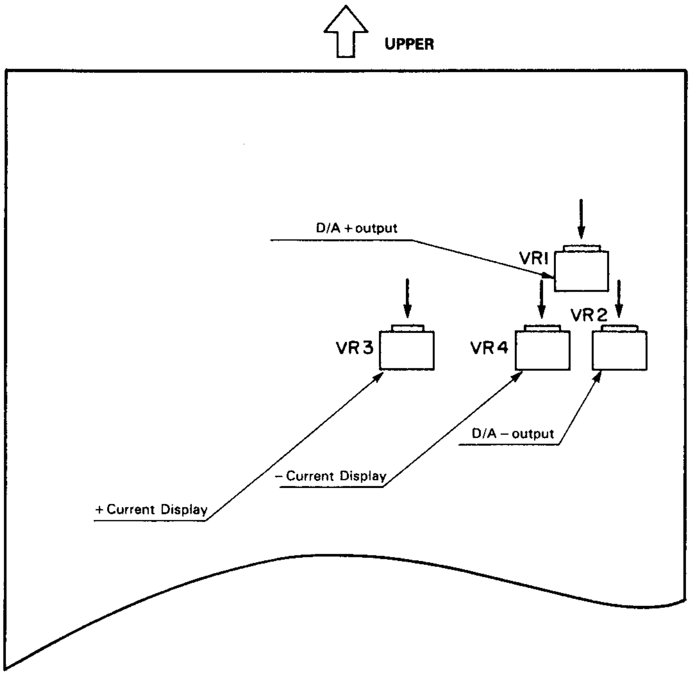
Item	Adjustment VR	P.C.B	Procedure
D/A + Output	VR1	X73-1880-02	1. Connect the multimeter as follows: Multimeter PW + to X73-1880-02 TP COM to COM₁ terminal on the panel At this point, set the multimeter to the voltage measurement mode. 2. Set the PW to the voltage adjustment mode. Turn the power switch ON pressing the KEYLOCK switch. Set the KEYLOCK switch free when the LEDs go on. At this point, all the 7-segment LEDs display "8". 3. Press the PRESET1 and observe the multimeter. Assume that the value at this point is P. 4. Press the PRESET2. Then adjust the VR1 so that the multimeter indicates (P+4.096) V. ±2mV
D/A − Output	VR2		1. Press the PRESET3 and observe the multimeter. Assume that the value at this point is Q. 2. Press the VARIABLE. Then adjust the VR2 so that the multimeter indicates (Q+4.096) V. ±2mV 3. Cancel the voltage adjustment mode by pressing the V switch. (Cancellation will take about 10 seconds.)
+ Current Display	VR3		1. Connect the multimeter as follows: Multimeter PW + to +18 V terminal on the panel COM to COM₁ terminal on the panel At this point, set the multimeter to the current measurement mode. 2. Turn the OUTPUT switch ON. Then adjust the multimeter by turning the rotary knob so that it indicates 1.00 A. At this point, make sure that the +18 V LED blinks and the unit maintains a constant current. 3. Adjust the VR3 so that the multimeter indicates 1.00 A.
− Current Display	VR4		1. Connect the multimeter as follows: Multimeter PW + to −18 V terminal on the panel COM to COM₁ terminal on the panel At this point, set the multimeter to the current measurement mode. 2. Display −18 V on the 7-segment LED by pressing the −18 V switch. 3. Turn the OUTPUT switch ON. Then adjust the multimeter by turning the rotary knob so that it indicates −1.00 A. At this point, make sure that the −18 V LED blinks and the unit maintains a constant current. 4. Adjust the VR4 so that the multimeter indicates −1.00 A.

ADJUSTMENT

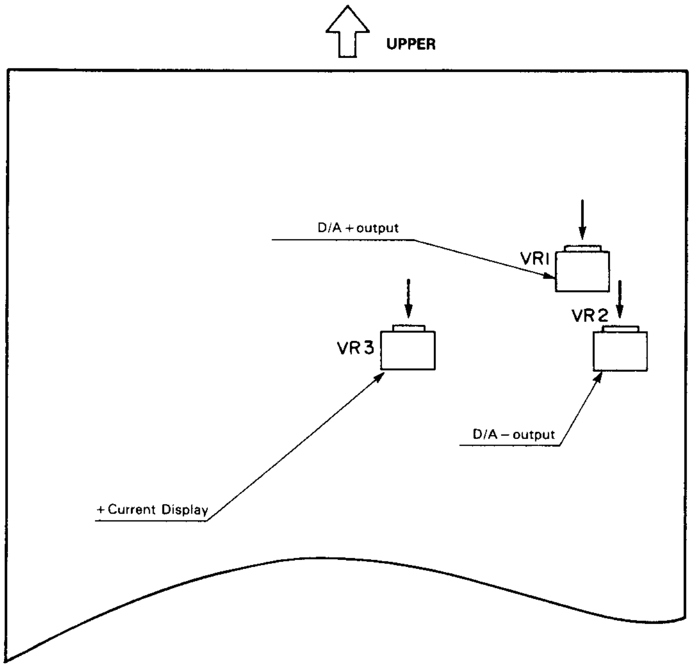
Item	Adjustment VR	P.C.B	Procedure
D/A + Output	VR1	X73-1880-03	1. Connect the multimeter as follows: Multimeter PW + to X73-1880-03 TP COM to +6 V terminal on the panel At this point, set the multimeter to the voltage measurement mode. 2. Set the PW to the voltage adjustment mode. Turn the power switch ON pressing the KEYLOCK switch. Set the KEYLOCK switch free when the LEDs go on. At this point, all the 7-segment LEDs display "8". 3. Press the PRESET1 and observe the multimeter. Assume that the value at this point is P. 4. Press the PRESET2. Then adjust the VR1 so that the multimeter indicates (P+4.096) V. ±2mV
D/A − Output	VR2		1. Press the PRESET3 and observe the multimeter. Assume that the value at this point is Q. 2. Press the VARIABLE. Then adjust the VR2 so that the multimeter indicates (Q+4.096) V. ±2mV 3. Cancel the voltage adjustment mode by pressing the V switch. (Cancellation will take about 10 seconds.)
− Current Display	VR4		1. Connect the multimeter as follows: Multimeter PW + to +6 V terminal on the panel COM to COM$_2$ terminal on the panel At this point, set the multimeter to the current measurement mode. 2. Display +6 V on the 7-segment LED by pressing the +6 V switch. 3. Turn the OUTPUT switch ON. Then adjust the multimeter by turning the rotary knob so that it indicates −1.00 A. At this point, make sure that the +6 V LED blinks and the unit maintains a constant current. 4. Adjust the VR4 so that the multimeter indicates −1.00 A.

ADJUSTMENT

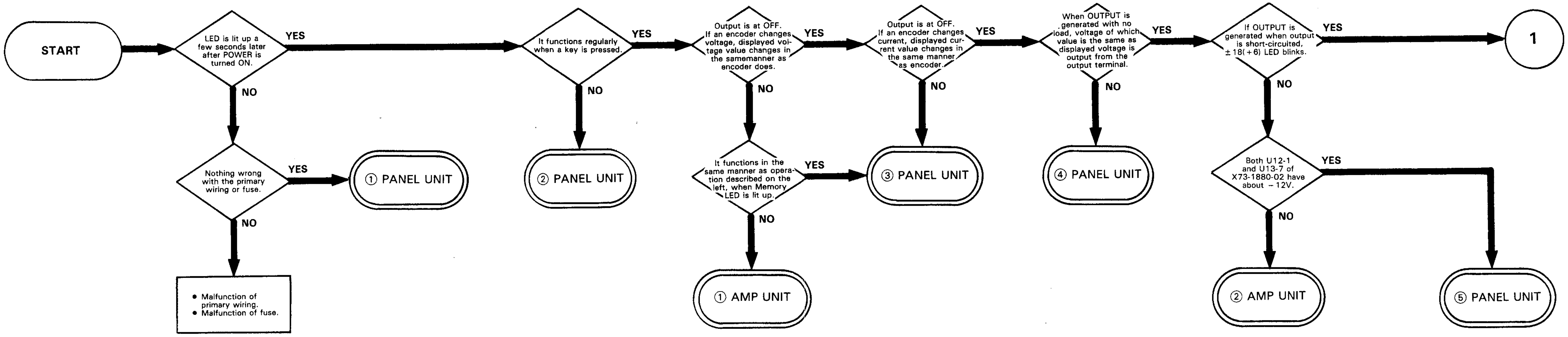
±18 AMP UNIT (X73-1880-02)

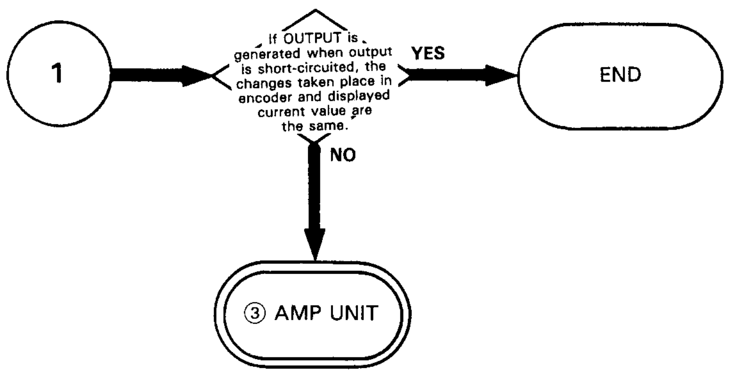

UPPER
D/A + output
VRI
VR2
VR3
VR4
D/A – output
– Current Display
+ Current Display

+6 AMP UNIT (X73-1880-03)

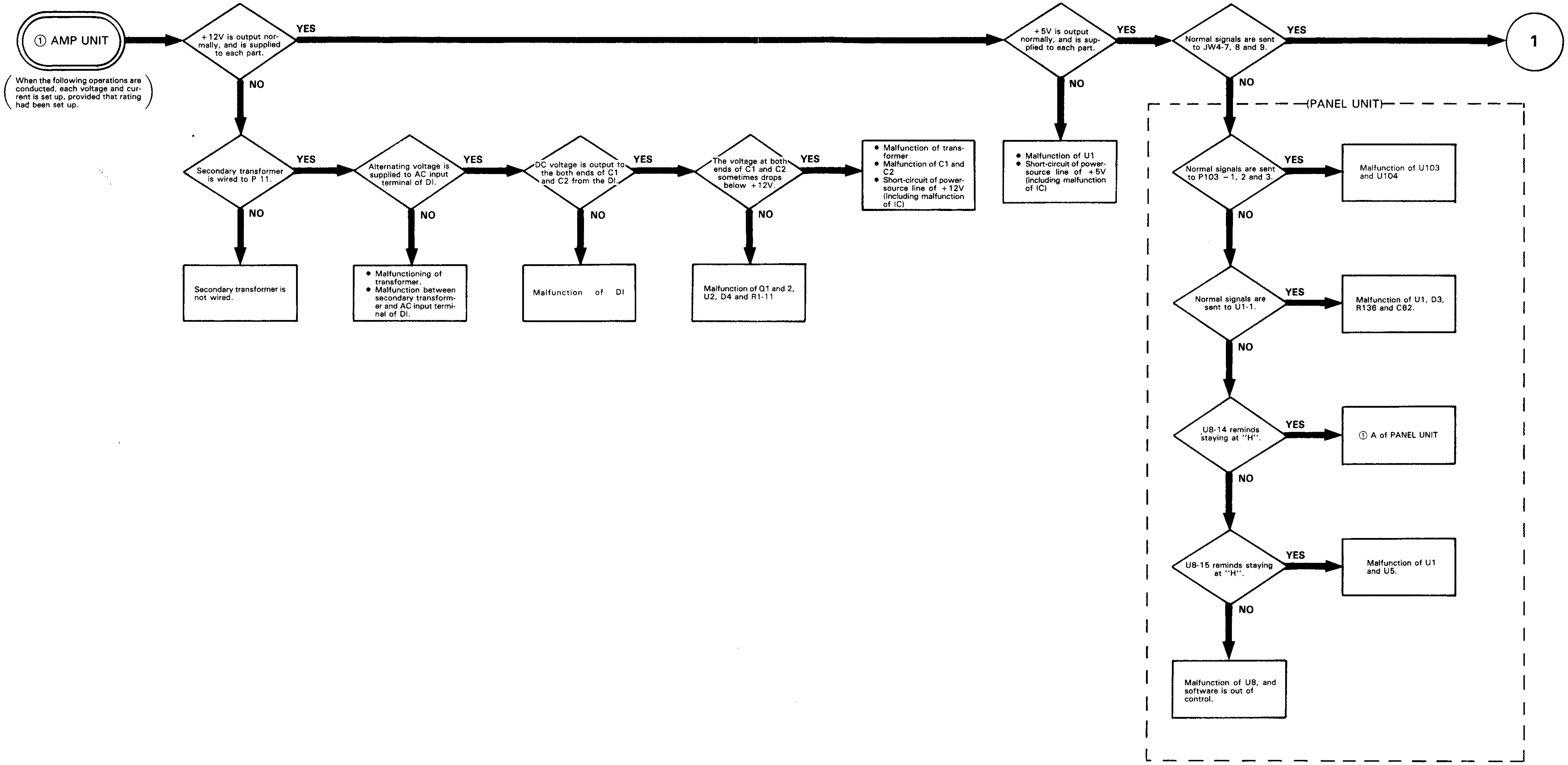

UPPER
D/A + output
VRI
VR2
VR3
D/A – output
+ Current Display

TROUBLESHOOTING


START
LED is lit up a few seconds later after POWER is turned ON.
YES
NO
Nothing wrong with the primary wiring or fuse.
YES
① PANEL UNIT
NO
• Malfunction of primary wiring.
• Malfunction of fuse.
It functions regularly when a key is pressed.
YES
NO
② PANEL UNIT
Output is at OFF. If an encoder changes voltage, displayed voltage value changes in the samemanner as encoder does.
YES
NO
It functions in the same manner as operation described on the left, when Memory LED is lit up.
YES
NO
① AMP UNIT
Output is at OFF. If an encoder changes current, displayed current value changes in the same manner as encoder.
YES
NO
③ PANEL UNIT
When OUTPUT is generated with no load, voltage of which value is the same as displayed voltage is output from the output terminal.
YES
NO
④ PANEL UNIT
If OUTPUT is generated when output is short-circuited, ± 18(+ 6) LED blinks.
YES
NO
1
Both U12-1 and U13-7 of X73-1880-02 have about – 12V.
YES
NO
② AMP UNIT
⑤ PANEL UNIT

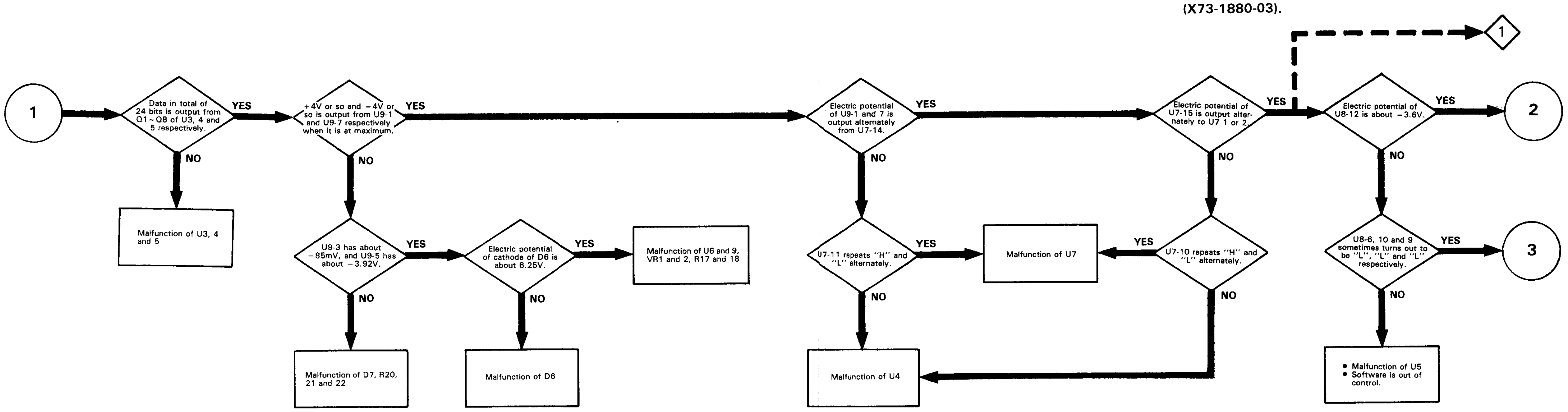

1
If OUTPUT is generated when output is short-circuited, the changes taken place in encoder and displayed current value are the same.
YES
END
NO
③ AMP UNIT

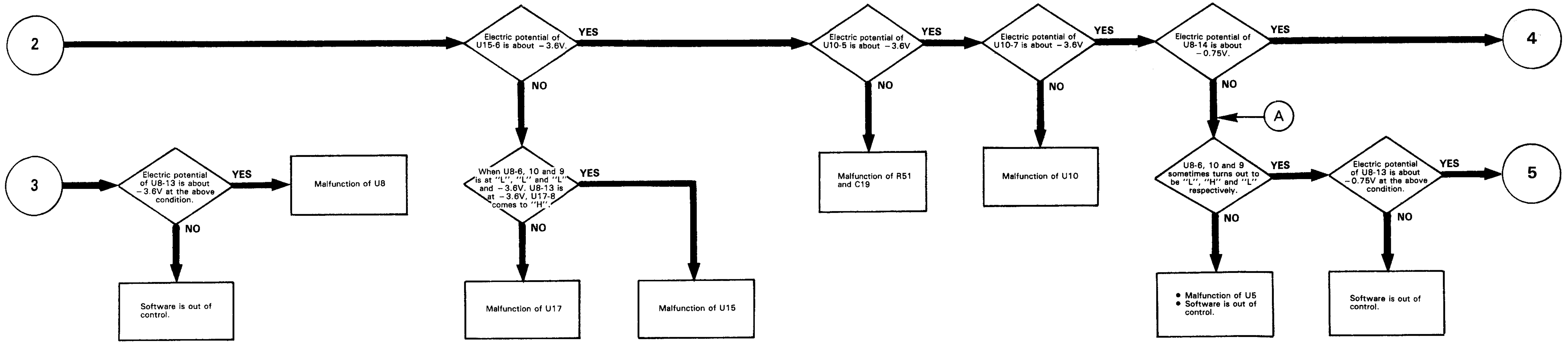
TROUBLESHOOTING


① AMP UNIT
When the following operations are conducted, each voltage and current is set up, provided that rating had been set up.
+12V is output normally, and is supplied to each part.
YES
NO
Secondary transformer is wired to P 11.
YES
NO
Secondary transformer is not wired.
Alternating voltage is supplied to AC input terminal of DI.
YES
NO
• Malfunctioning of transformer.
• Malfunction between secondary transformer and AC input terminal of DI.
DC voltage is output to the both ends of C1 and C2 from the DI.
YES
NO
Malfunction of DI
The voltage at both ends of C1 and C2 sometimes drops below +12V.
YES
NO
Malfunction of Q1 and 2, U2, D4 and R1-11
• Malfunction of transformer
• Malfunction of C1 and C2
• Short-circuit of power-source line of +12V (Including malfunction of IC)
+5V is output normally, and is supplied to each part.
YES
NO
• Malfunction of U1
• Short-circuit of power-source line of +5V (including malfunction of IC)
Normal signals are sent to JW4-7, 8 and 9.
YES
1
NO
(PANEL UNIT)
Normal signals are sent to P103 – 1, 2 and 3.
YES
Malfunction of U103 and U104
NO
Normal signals are sent to U1-1.
YES
Malfunction of U1, D3, R136 and C62.
NO
U8-14 reminds staying at "H".
YES
① A of PANEL UNIT
NO
U8-15 reminds staying at "H".
YES
Malfunction of U1 and U5.
NO
Malfunction of U8, and software is out of control.

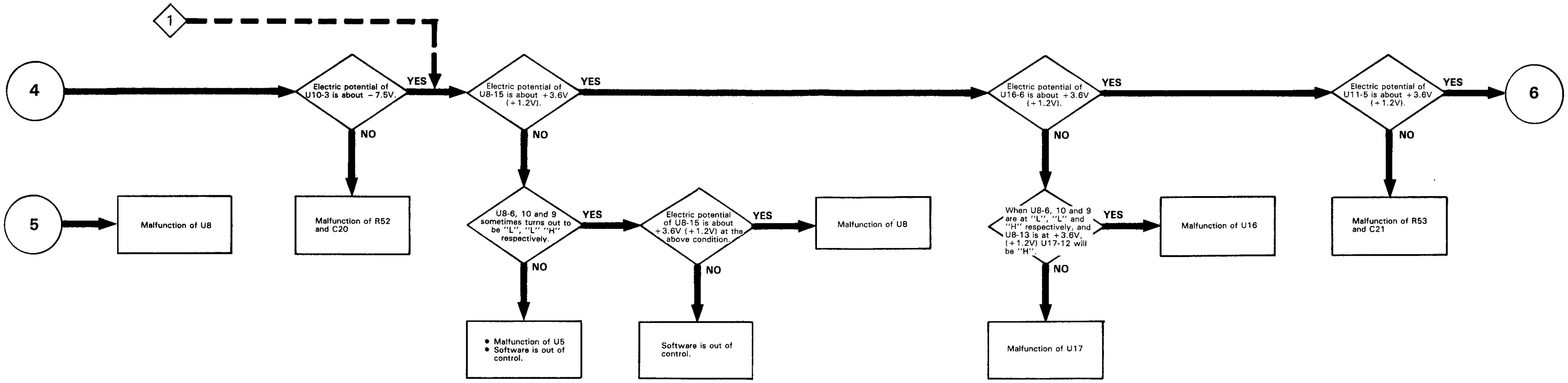
TROUBLESHOOTING

Note:
Subflow is applicable only in case of the AMP UNIT (X73-1880-03).


1
Data in total of 24 bits is output from Q1~Q8 of U3, 4 and 5 respectively.
YES
NO
Malfunction of U3, 4 and 5
+4V or so and −4V or so is output from U9-1 and U9-7 respectively when it is at maximum.
YES
NO
U9-3 has about −85mV, and U9-5 has about −3.92V.
YES
NO
Malfunction of D7, R20, 21 and 22
Electric potential of cathode of D6 is about 6.25V.
YES
NO
Malfunction of U6 and 9, VR1 and 2, R17 and 18
Malfunction of D6
Electric potential of U9-1 and 7 is output alternately from U7-14.
YES
NO
U7-11 repeats "H" and "L" alternately.
YES
NO
Malfunction of U7
Malfunction of U4
Electric potential of U7-15 is output alternately to U7 1 or 2.
YES
NO
U7-10 repeats "H" and "L" alternately.
YES
NO
1
Electric potential of U8-12 is about −3.6V.
YES
NO
2
U8-6, 10 and 9 sometimes turns out to be "L", "L" and "L" respectively.
YES
NO
3
• Malfunction of U5
• Software is out of control.

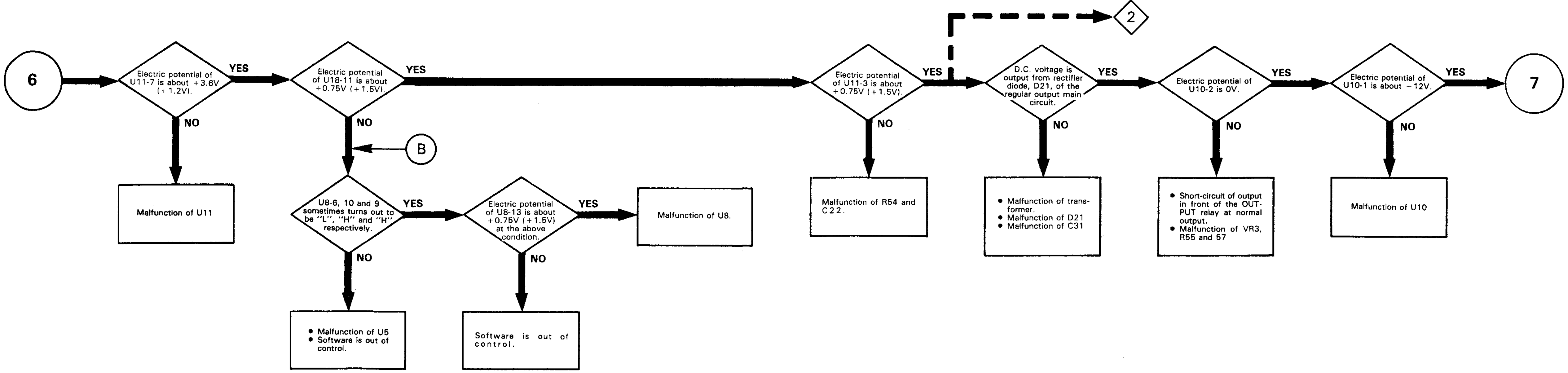

2
Electric potential of U15-6 is about −3.6V.
YES
NO
When U8-6, 10 and 9 is at "L", "L" and "L" and −3.6V, U8-13 is at −3.6V, U17-8 comes to "H".
YES
NO
Malfunction of U17
Malfunction of U15
Electric potential of U10-5 is about −3.6V
YES
NO
Malfunction of R51 and C19
Electric potential of U10-7 is about −3.6V
YES
NO
Malfunction of U10
Electric potential of U8-14 is about −0.75V.
YES
NO
4
A
U8-6, 10 and 9 sometimes turns out to be "L", "H" and "L" respectively.
YES
NO
• Malfunction of U5
• Software is out of control.
Electric potential of U8-13 is about −0.75V at the above condition.
YES
NO
5
Software is out of control.
3
Electric potential of U8-13 is about −3.6V at the above condition.
YES
NO
Malfunction of U8
Software is out of control.

TROUBLESHOOTING


1
4
Electric potential of U10-3 is about −7.5V.
YES
NO
Malfunction of R52 and C20
Electric potential of U8-15 is about +3.6V (+1.2V).
YES
NO
U8-6, 10 and 9 sometimes turns out to be "L", "L" "H" respectively.
YES
NO
• Malfunction of U5
• Software is out of control.
Electric potential of U8-15 is about +3.6V (+1.2V) at the above condition.
YES
NO
Software is out of control.
Malfunction of U8
Electric potential of U16-6 is about +3.6V (+1.2V).
YES
NO
When U8-6, 10 and 9 are at "L", "L" and "H" respectively, and U8-13 is at +3.6V, (+1.2V) U17-12 will be "H".
YES
NO
Malfunction of U16
Malfunction of U17
Electric potential of U11-5 is about +3.6V (+1.2V).
YES
NO
Malfunction of R53 and C21
6
5
Malfunction of U8

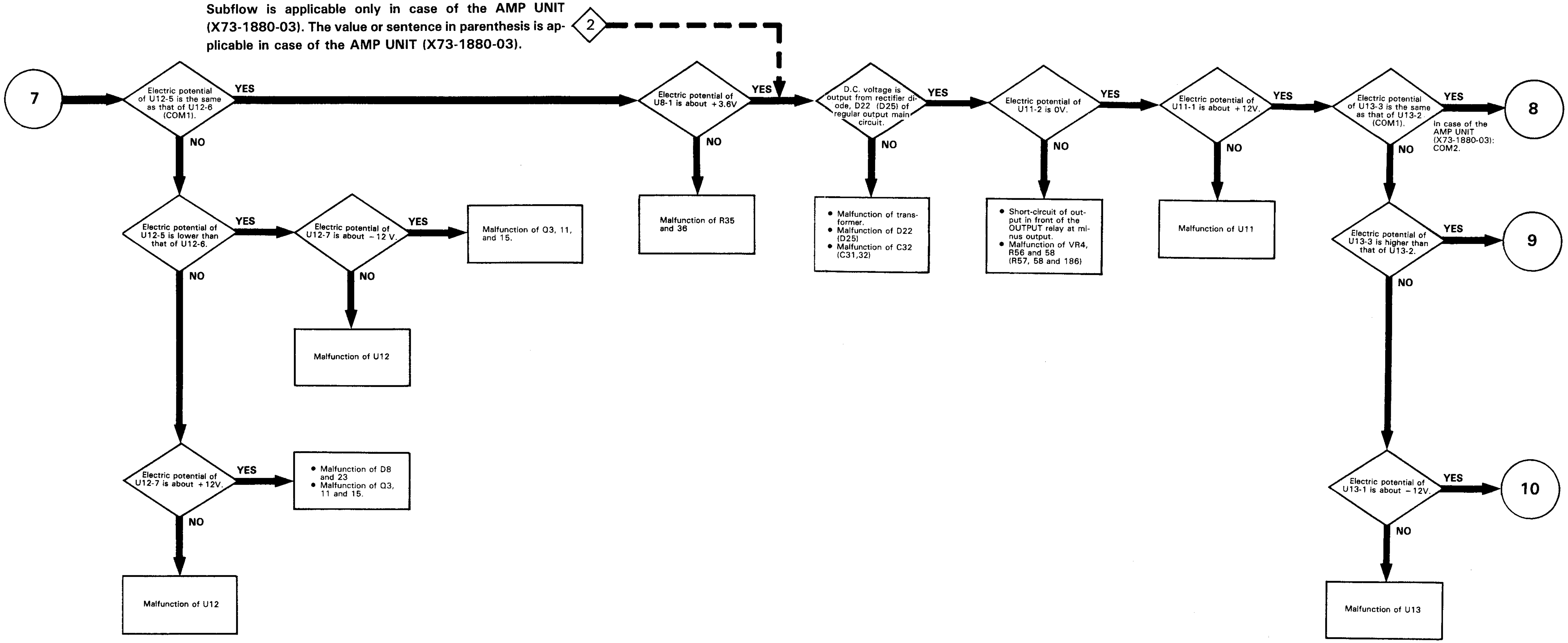
Note:

Subflow is applicable only in case of the AMP UNIT (X73-1880-03). The value or sentence in parenthesis is applicable in case of the AMP UNIT (X73-1880-03).


6
Electric potential of U11-7 is about +3.6V (+1.2V).
YES
NO
Malfunction of U11
Electric potential of U18-11 is about +0.75V (+1.5V).
YES
NO
B
U8-6, 10 and 9 sometimes turns out to be "L", "H" and "H" respectively.
YES
NO
• Malfunction of U5
• Software is out of control.
Electric potential of U8-13 is about +0.75V (+1.5V) at the above condition.
YES
NO
Software is out of control.
Malfunction of U8.
Electric potential of U11-3 is about +0.75V (+1.5V).
YES
NO
Malfunction of R54 and C22.
2
D.C. voltage is output from rectifier diode, D21, of the regular output main circuit.
YES
NO
• Malfunction of transformer.
• Malfunction of D21
• Malfunction of C31
Electric potential of U10-2 is 0V.
YES
NO
• Short-circuit of output in front of the OUTPUT relay at normal output.
• Malfunction of VR3, R55 and 57
Electric potential of U10-1 is about −12V.
YES
NO
Malfunction of U10
7

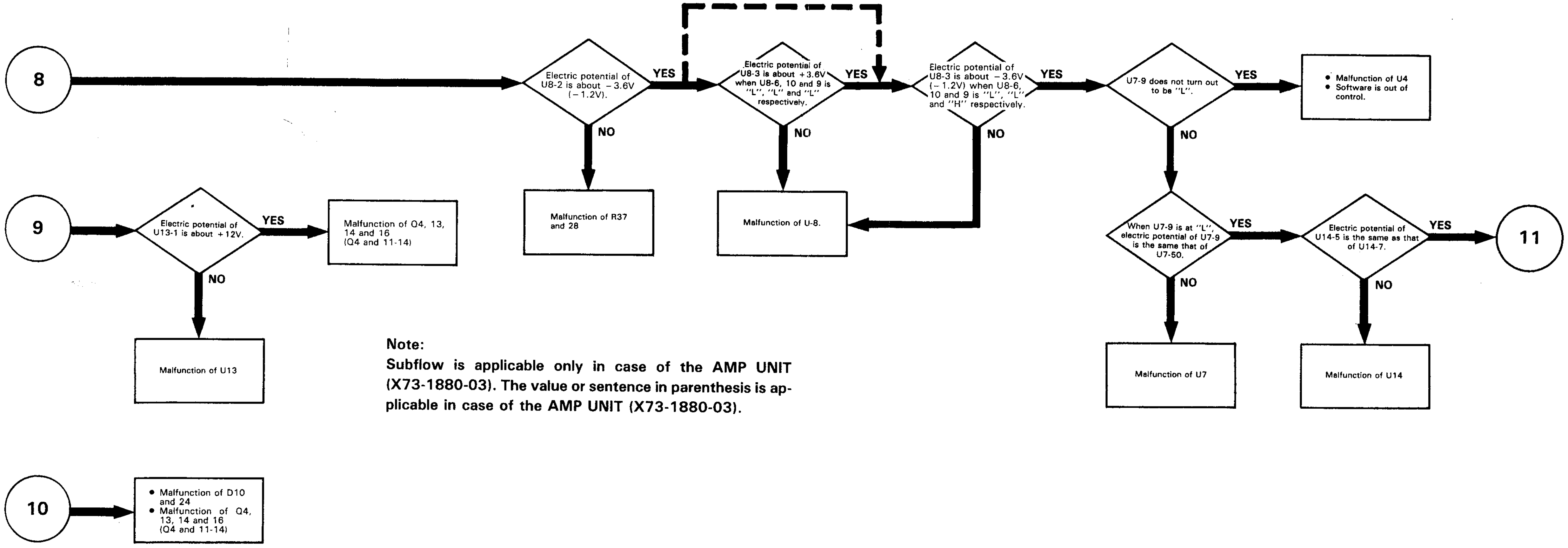
TROUBLESHOOTING

Note:
Subflow is applicable only in case of the AMP UNIT (X73-1880-03). The value or sentence in parenthesis is applicable in case of the AMP UNIT (X73-1880-03).



2
7
Electric potential of U12-5 is the same as that of U12-6 (COM1).
YES
NO
Electric potential of U12-5 is lower than that of U12-6.
YES
NO
Electric potential of U12-7 is about −12 V.
YES
NO
Malfunction of Q3, 11, and 15.
Malfunction of U12
Electric potential of U12-7 is about +12V.
YES
NO
• Malfunction of D8 and 23
• Malfunction of Q3, 11 and 15.
Malfunction of U12
Electric potential of U8-1 is about +3.6V
YES
NO
Malfunction of R35 and 36
D.C. voltage is output from rectifier diode, D22 (D25) of regular output main circuit.
YES
NO
• Malfunction of transformer.
• Malfunction of D22 (D25)
• Malfunction of C32 (C31,32)
Electric potential of U11-2 is 0V.
YES
NO
• Short-circuit of output in front of the OUTPUT relay at minus output.
• Malfunction of VR4, R56 and 58 (R57, 58 and 186)
Electric potential of U11-1 is about +12V.
YES
NO
Malfunction of U11
Electric potential of U13-3 is the same as that of U13-2 (COM1).
YES
NO
In case of the AMP UNIT (X73-1880-03): COM2.
8
Electric potential of U13-3 is higher than that of U13-2.
YES
NO
9
Electric potential of U13-1 is about −12V.
YES
NO
10
Malfunction of U13

TROUBLESHOOTING


8
Electric potential of U8-2 is about −3.6V (−1.2V).
YES
NO
Malfunction of R37 and 28
Electric potential of U8-3 is about +3.6V when U8-6, 10 and 9 is "L", "L" and "L" respectively.
YES
NO
Malfunction of U-8.
Electric potential of U8-3 is about −3.6V (−1.2V) when U8-6, 10 and 9 is "L", "L" and "H" respectively.
YES
NO
U7-9 does not turn out to be "L".
YES
• Malfunction of U4
• Software is out of control.
NO
When U7-9 is at "L", electric potential of U7-9 is the same that of U7-50.
YES
NO
Malfunction of U7
Electric potential of U14-5 is the same as that of U14-7.
YES
NO
Malfunction of U14
11
9
Electric potential of U13-1 is about +12V.
YES
Malfunction of Q4, 13, 14 and 16 (Q4 and 11-14)
NO
Malfunction of U13
10
• Malfunction of D10 and 24
• Malfunction of Q4, 13, 14 and 16 (Q4 and 11-14)

Note:
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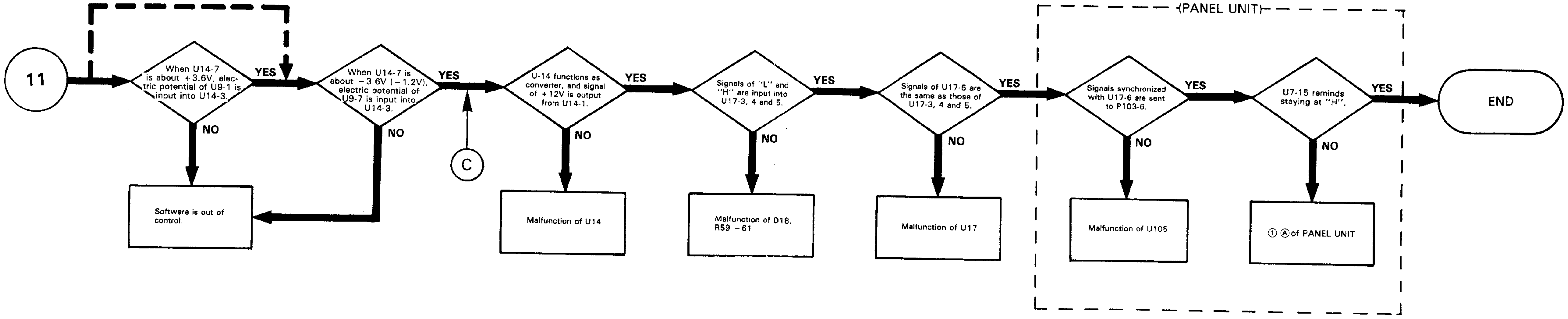
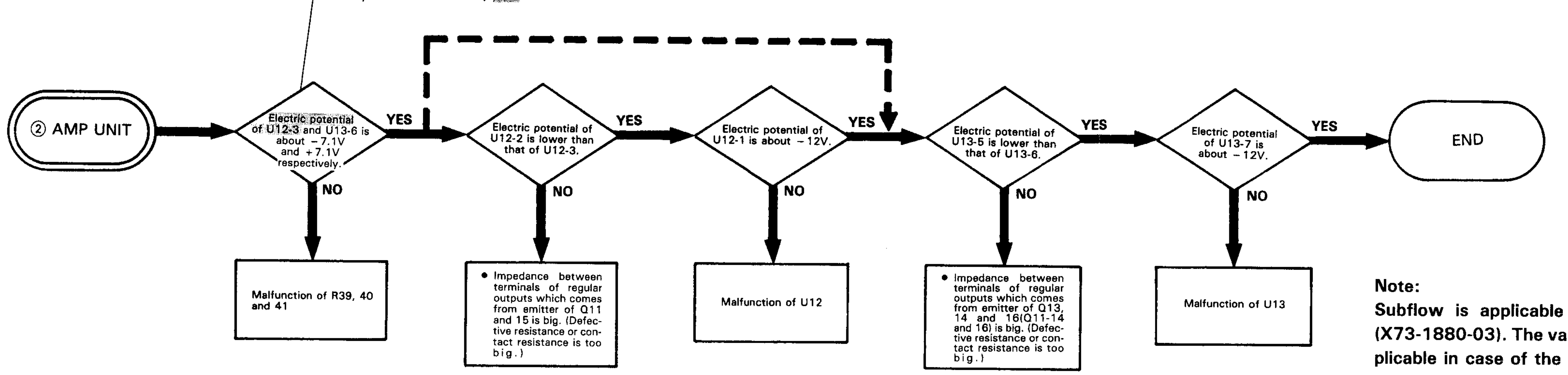

11
When U14-7 is about +3.6V, electric potential of U9-1 is input into U14-3.
YES
NO
Software is out of control.
When U14-7 is about −3.6V (−1.2V), electric potential of U9-7 is input into U14-3.
YES
NO
C
U-14 functions as converter, and signal of +12V is output from U14-1.
YES
NO
Malfunction of U14
Signals of "L" and "H" are input into U17-3, 4 and 5.
YES
NO
Malfunction of D18, R59 −61
Signals of U17-6 are the same as those of U17-3, 4 and 5.
YES
NO
Malfunction of U17
(PANEL UNIT)
Signals synchronized with U17-6 are sent to P103-6.
YES
NO
Malfunction of U105
U7-15 reminds staying at "H".
YES
NO
① Ⓐ of PANEL UNIT
END

TROUBLESHOOTING

The portion indicated by ▨ is not attached to the X73-1880-03 unit.


② AMP UNIT
Electric potential of U12-3 and U13-6 is about −7.1V and +7.1V respectively.
YES
NO
Malfunction of R39, 40 and 41
Electric potential of U12-2 is lower than that of U12-3.
YES
NO
• Impedance between terminals of regular outputs which comes from emitter of Q11 and 15 is big. (Defective resistance or contact resistance is too big.)
Electric potential of U12-1 is about −12V.
YES
NO
Malfunction of U12
Electric potential of U13-5 is lower than that of U13-6.
YES
NO
• Impedance between terminals of regular outputs which comes from emitter of Q13, 14 and 16(Q11-14 and 16) is big. (Defective resistance or contact resistance is too big.)
Electric potential of U13-7 is about −12V.
YES
NO
Malfunction of U13
END

Note:

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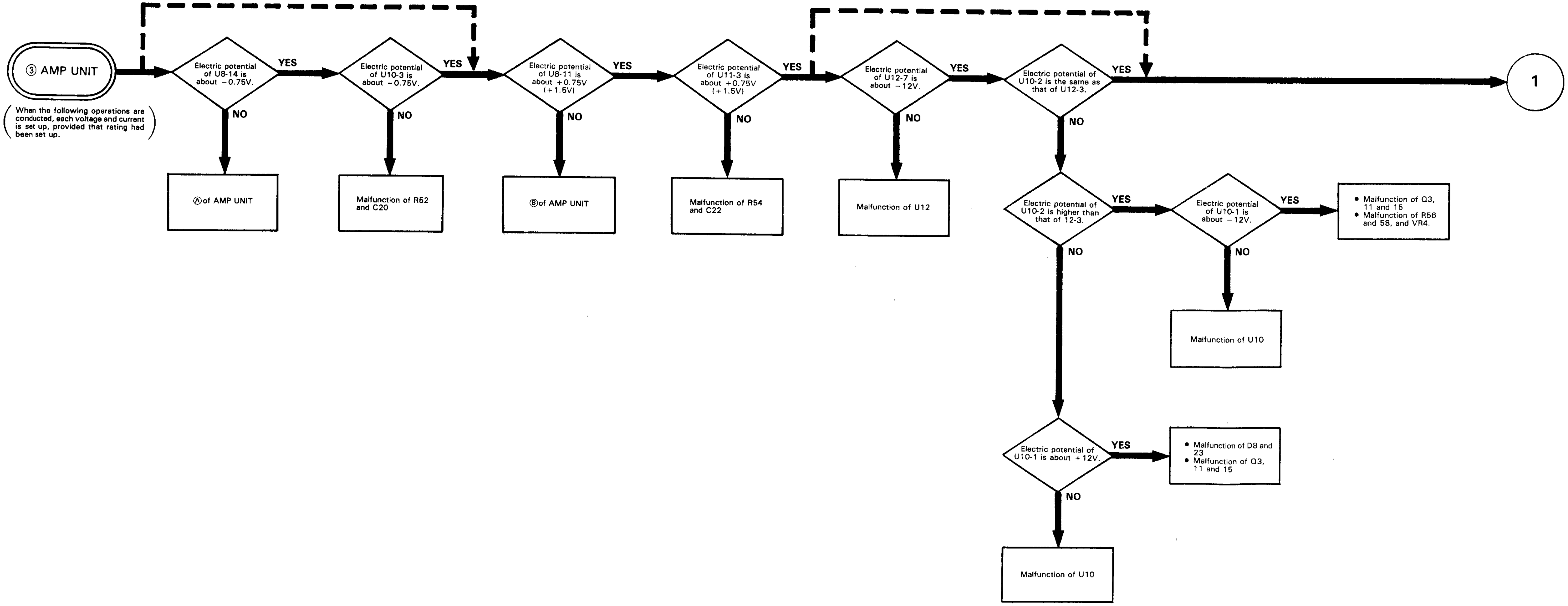
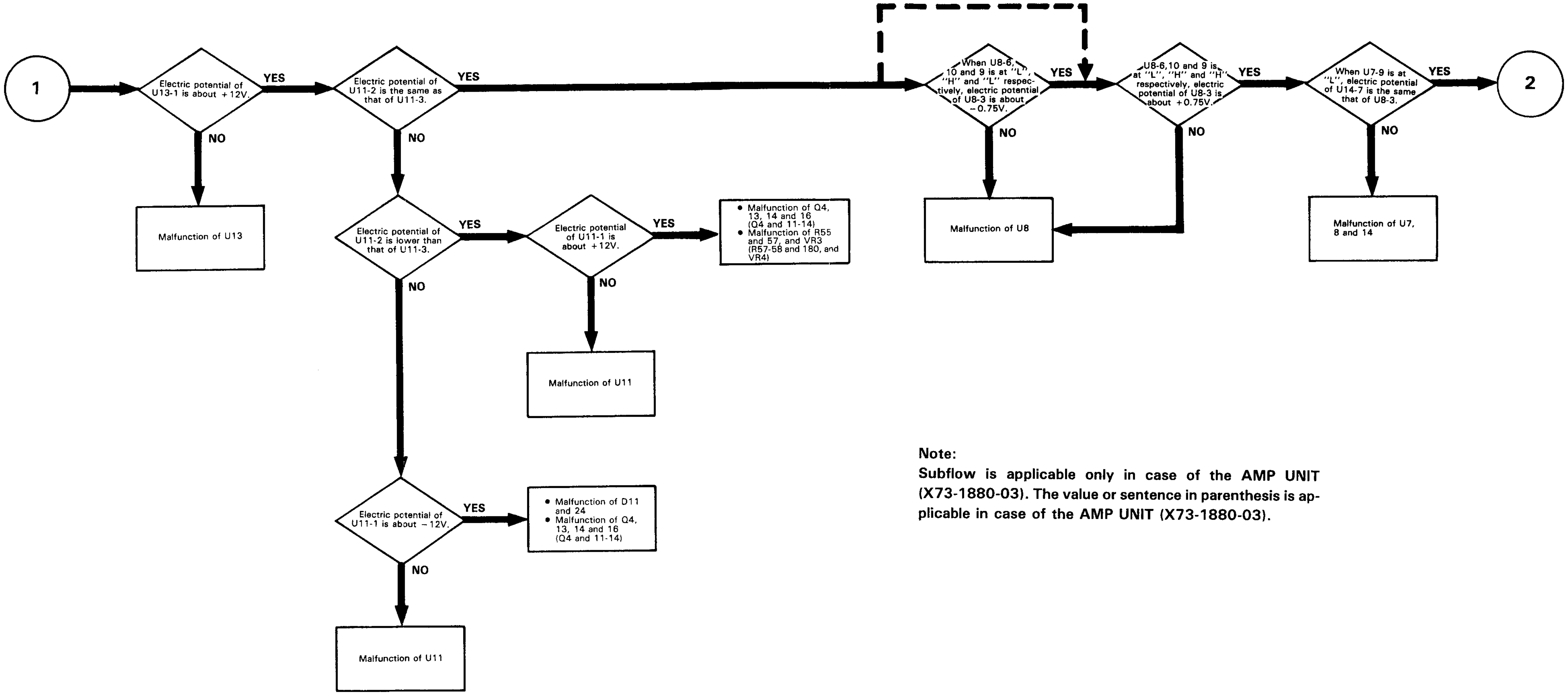

③ AMP UNIT
Electric potential of U8-14 is about −0.75V.
YES
NO
Ⓐof AMP UNIT
Electric potential of U10-3 is about −0.75V.
YES
NO
Malfunction of R52 and C20
Electric potential of U8-11 is about +0.75V (+1.5V)
YES
NO
Ⓑof AMP UNIT
Electric potential of U11-3 is about +0.75V (+1.5V)
YES
NO
Malfunction of R54 and C22
Electric potential of U12-7 is about −12V.
YES
NO
Malfunction of U12
Electric potential of U10-2 is the same as that of U12-3.
YES
NO
1
Electric potential of U10-2 is higher than that of 12-3.
YES
NO
Electric potential of U10-1 is about −12V.
YES
NO
• Malfunction of Q3, 11 and 15
• Malfunction of R56 and 58, and VR4.
Malfunction of U10
Electric potential of U10-1 is about +12V.
YES
NO
• Malfunction of D8 and 23
• Malfunction of Q3, 11 and 15
Malfunction of U10

(When the following operations are conducted, each voltage and current is set up, provided that rating had been set up.)

TROUBLESHOOTING


1
Electric potential of U13-1 is about +12V.
YES
NO
Malfunction of U13
Electric potential of U11-2 is the same as that of U11-3.
YES
NO
Electric potential of U11-2 is lower than that of U11-3.
YES
NO
Electric potential of U11-1 is about +12V.
YES
NO
• Malfunction of Q4, 13, 14 and 16 (Q4 and 11-14)
• Malfunction of R55 and 57, and VR3 (R57-58 and 180, and VR4)
Malfunction of U11
Electric potential of U11-1 is about −12V.
YES
NO
• Malfunction of D11 and 24
• Malfunction of Q4, 13, 14 and 16 (Q4 and 11-14)
Malfunction of U11
When U8-6, 10 and 9 is at "L", "H" and "L" respectively, electric potential of U8-3 is about −0.75V.
YES
NO
Malfunction of U8
U8-6,10 and 9 is at "L", "H" and "H" respectively, electric potential of U8-3 is about +0.75V.
YES
NO
When U7-9 is at "L", electric potential of U14-7 is the same that of U8-3.
YES
NO
Malfunction of U7, 8 and 14
2

Note:
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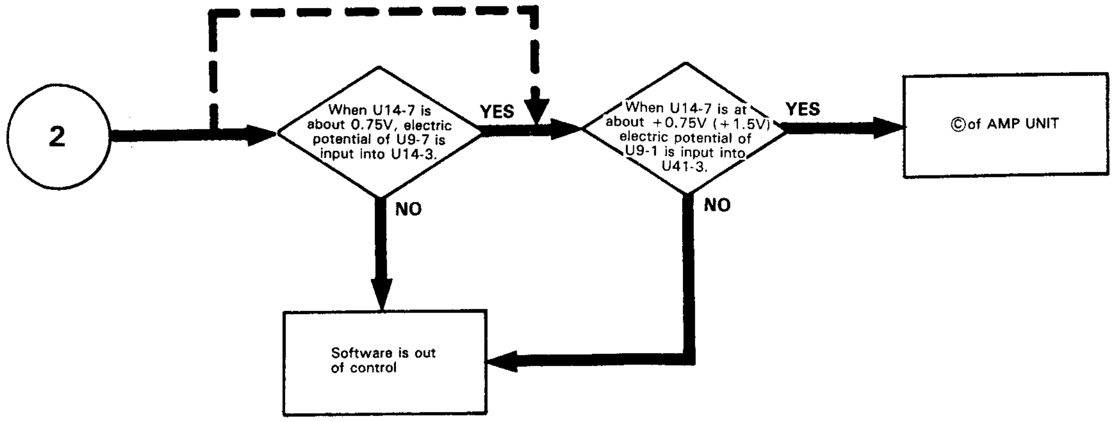
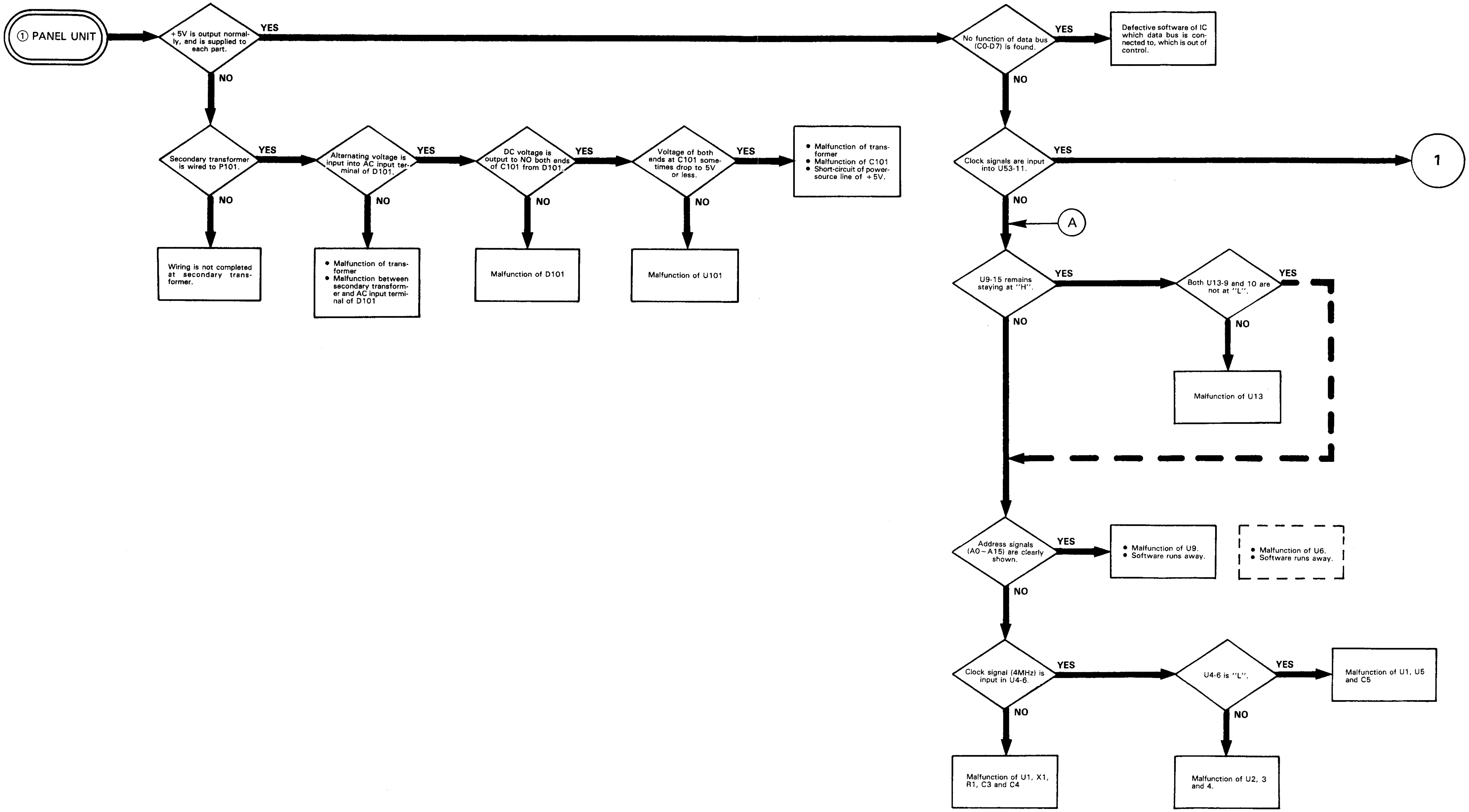
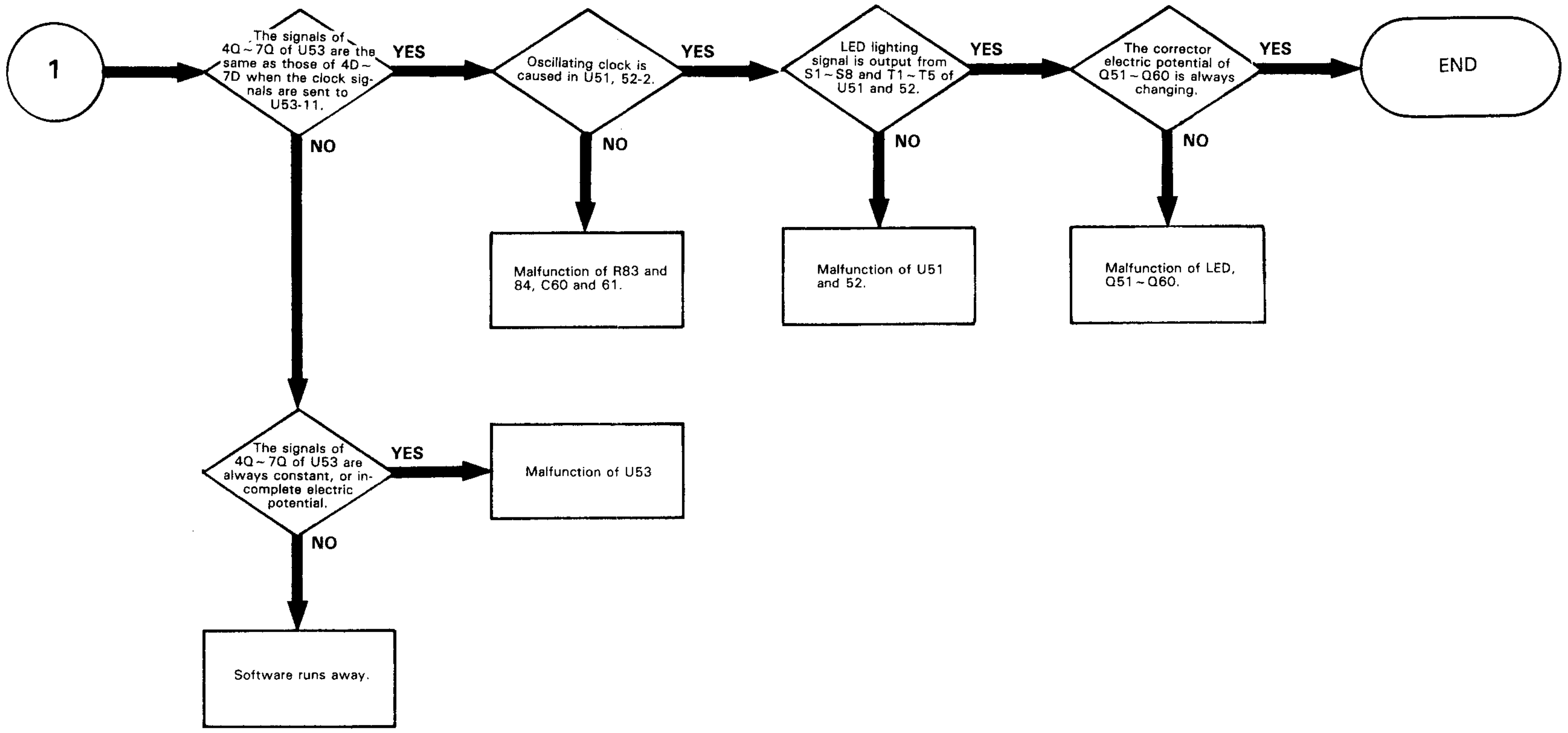

2
When U14-7 is about 0.75V, electric potential of U9-7 is input into U14-3.
YES
NO
When U14-7 is at about +0.75V (+1.5V) electric potential of U9-1 is input into U41-3.
YES
NO
©of AMP UNIT
Software is out of control

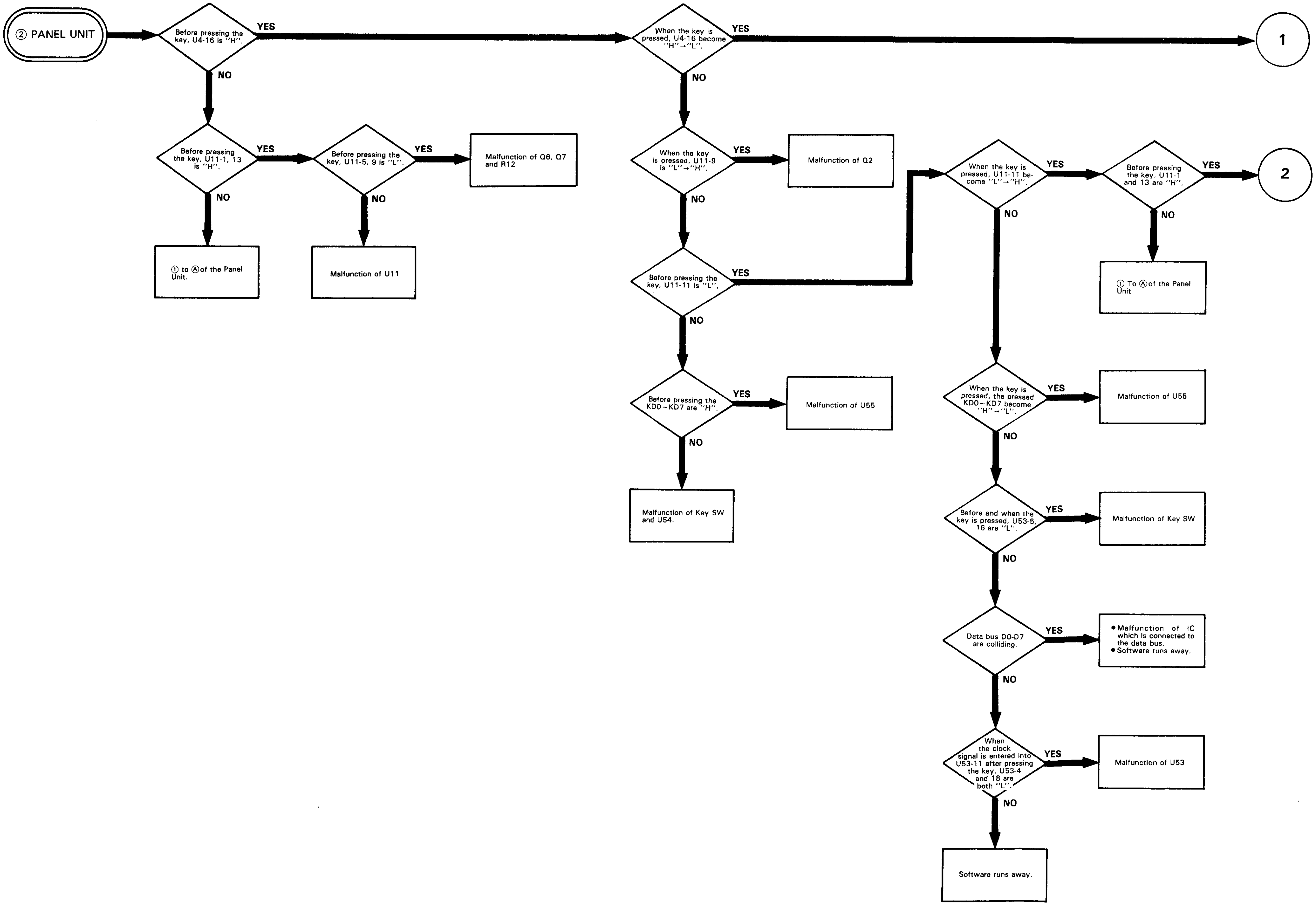
TROUBLESHOOTING


① PANEL UNIT
+5V is output normally, and is supplied to each part.
YES
NO
Secondary transformer is wired to P101.
YES
NO
Wiring is not completed at secondary transformer.
Alternating voltage is input into AC input terminal of D101.
YES
NO
• Malfunction of transformer
• Malfunction between secondary transformer and AC input terminal of D101
DC voltage is output to NO both ends of C101 from D101.
YES
NO
Malfunction of D101
Voltage of both ends at C101 sometimes drop to 5V or less.
YES
NO
Malfunction of U101
• Malfunction of transformer
• Malfunction of C101
• Short-circuit of power-source line of +5V.
No function of data bus (C0-D7) is found.
YES
NO
Defective software of IC which data bus is connected to, which is out of control.
Clock signals are input into U53-11.
YES
NO
1
A
U9-15 remains staying at "H".
YES
NO
Both U13-9 and 10 are not at "L".
YES
NO
Malfunction of U13
Address signals (A0~A15) are clearly shown.
YES
NO
• Malfunction of U9.
• Software runs away.
• Malfunction of U6.
• Software runs away.
Clock signal (4MHz) is input in U4-6.
YES
NO
Malfunction of U1, X1, R1, C3 and C4
U4-6 is "L".
YES
NO
Malfunction of U1, U5 and C5
Malfunction of U2, 3 and 4.

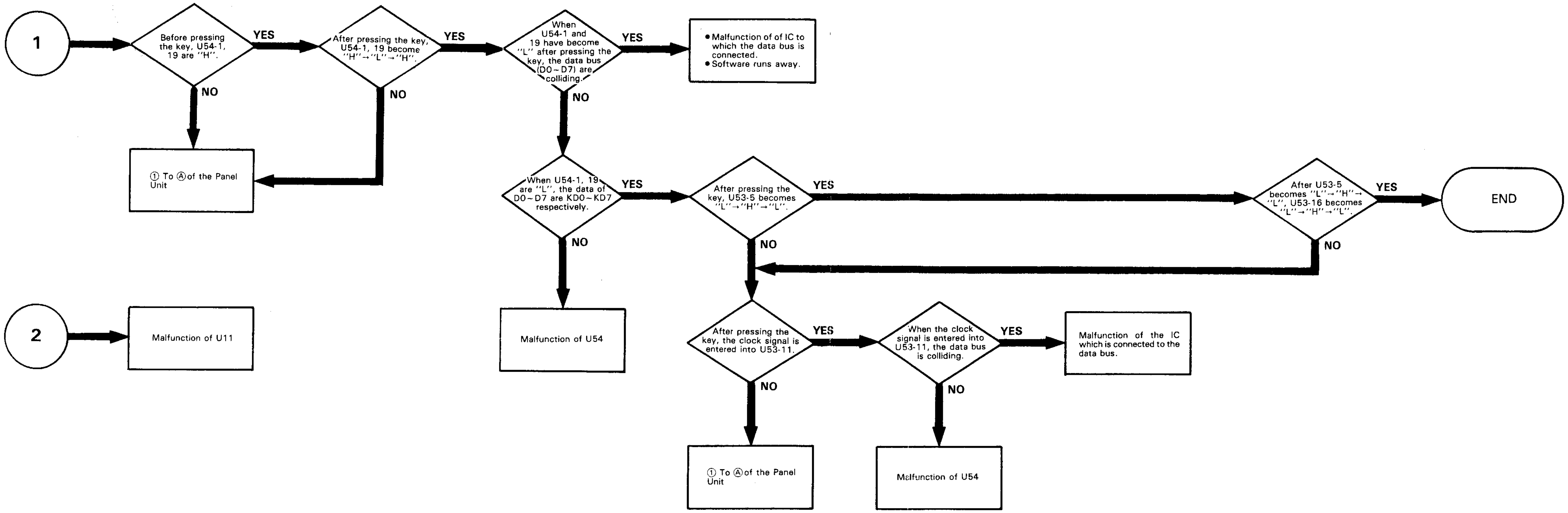
TROUBLESHOOTING


1
The signals of 4Q ~ 7Q of U53 are the same as those of 4D ~ 7D when the clock signals are sent to U53-11.
YES
NO
Oscillating clock is caused in U51, 52-2.
YES
NO
Malfunction of R83 and 84, C60 and 61.
LED lighting signal is output from S1 ~ S8 and T1 ~ T5 of U51 and 52.
YES
NO
Malfunction of U51 and 52.
The corrector electric potential of Q51 ~ Q60 is always changing.
YES
NO
Malfunction of LED, Q51 ~ Q60.
END
The signals of 4Q ~ 7Q of U53 are always constant, or incomplete electric potential.
YES
Malfunction of U53
NO
Software runs away.

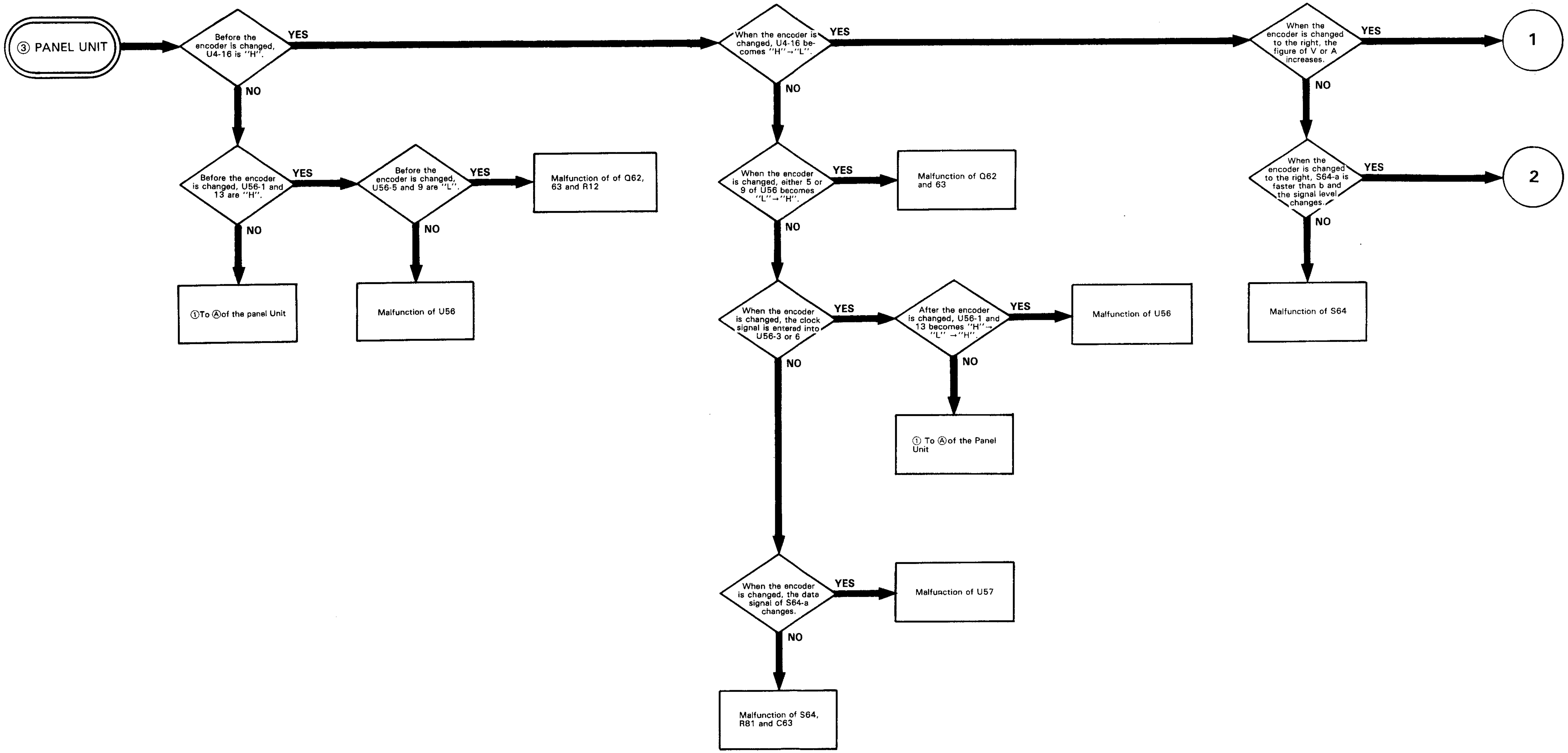
TROUBLESHOOTING


② PANEL UNIT
Before pressing the key, U4-16 is "H".
YES
NO
Before pressing the key, U11-1, 13 is "H".
YES
NO
① to Ⓐof the Panel Unit.
Before pressing the key, U11-5, 9 is "L".
YES
NO
Malfunction of U11
Malfunction of Q6, Q7 and R12
When the key is pressed, U4-16 become "H"→"L".
YES
NO
1
When the key is pressed, U11-9 is "L"→"H".
YES
NO
Malfunction of Q2
Before pressing the key, U11-11 is "L".
YES
NO
Before pressing the KD0~KD7 are "H".
YES
NO
Malfunction of U55
Malfunction of Key SW and U54.
When the key is pressed, U11-11 become "L"→"H".
YES
NO
Before pressing the key, U11-1 and 13 are "H".
YES
NO
2
① To Ⓐof the Panel Unit
When the key is pressed, the pressed KD0~KD7 become "H"→"L".
YES
NO
Malfunction of U55
Before and when the key is pressed, U53-5, 16 are "L".
YES
NO
Malfunction of Key SW
Data bus D0-D7 are colliding.
YES
NO
● Malfunction of IC which is connected to the data bus.
● Software runs away.
When the clock signal is entered into U53-11 after pressing the key, U53-4 and 18 are both "L".
YES
NO
Malfunction of U53
Software runs away.

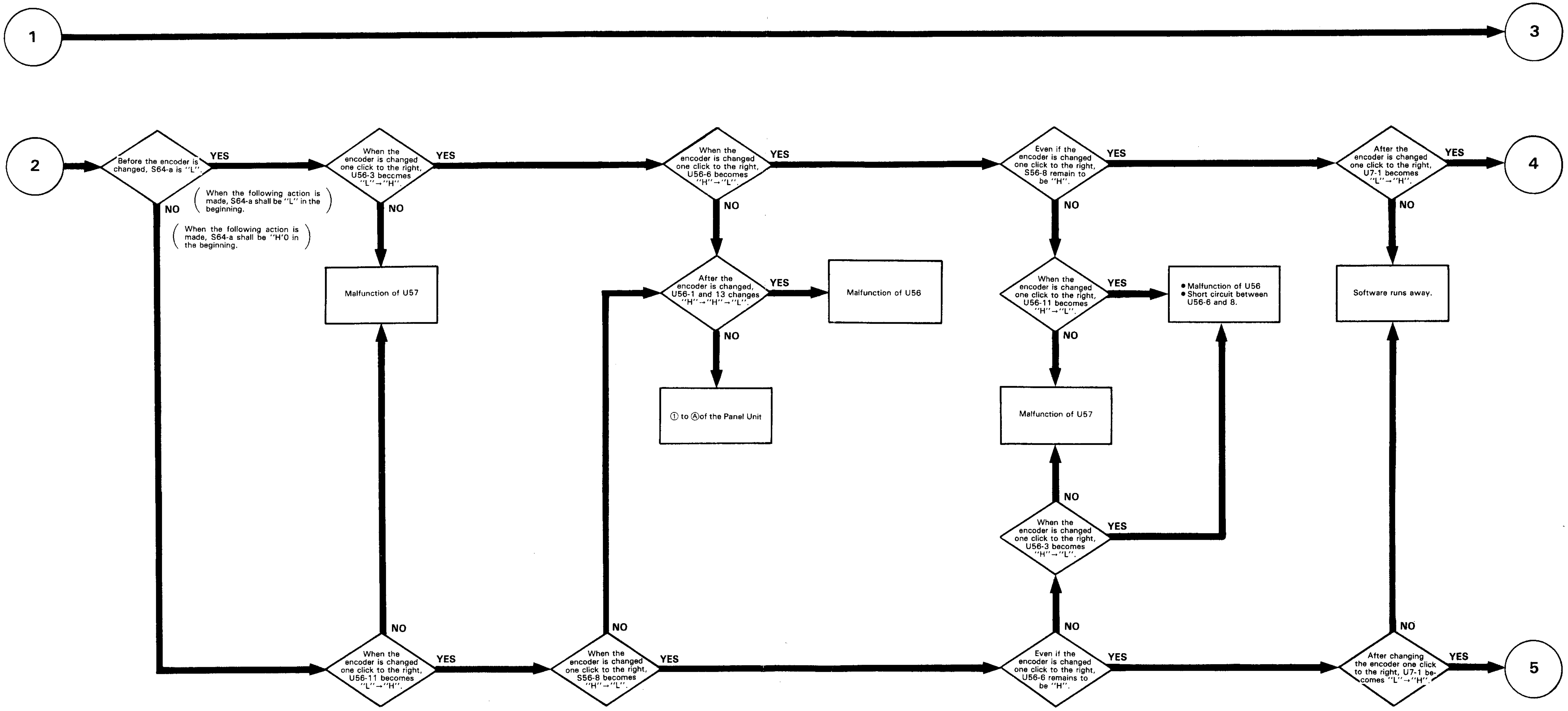
TROUBLESHOOTING


1
Before pressing the key, U54-1, 19 are "H".
YES
NO
After pressing the key, U54-1, 19 become "H"→"L"→"H".
YES
NO
When U54-1 and 19 have become "L" after pressing the key, the data bus (D0~D7) are colliding.
YES
NO
• Malfunction of of IC to which the data bus is connected.
• Software runs away.
① To Ⓐof the Panel Unit
When U54-1, 19 are "L", the data of D0~D7 are KD0~KD7 respectively.
YES
NO
After pressing the key, U53-5 becomes "L"→"H"→"L".
YES
NO
After U53-5 becomes "L"→"H"→"L", U53-16 becomes "L"→"H"→"L".
YES
NO
END
2
Malfunction of U11
Malfunction of U54
After pressing the key, the clock signal is entered into U53-11.
YES
NO
When the clock signal is entered into U53-11, the data bus is colliding.
YES
NO
Malfunction of the IC which is connected to the data bus.
① To Ⓐof the Panel Unit
Malfunction of U54

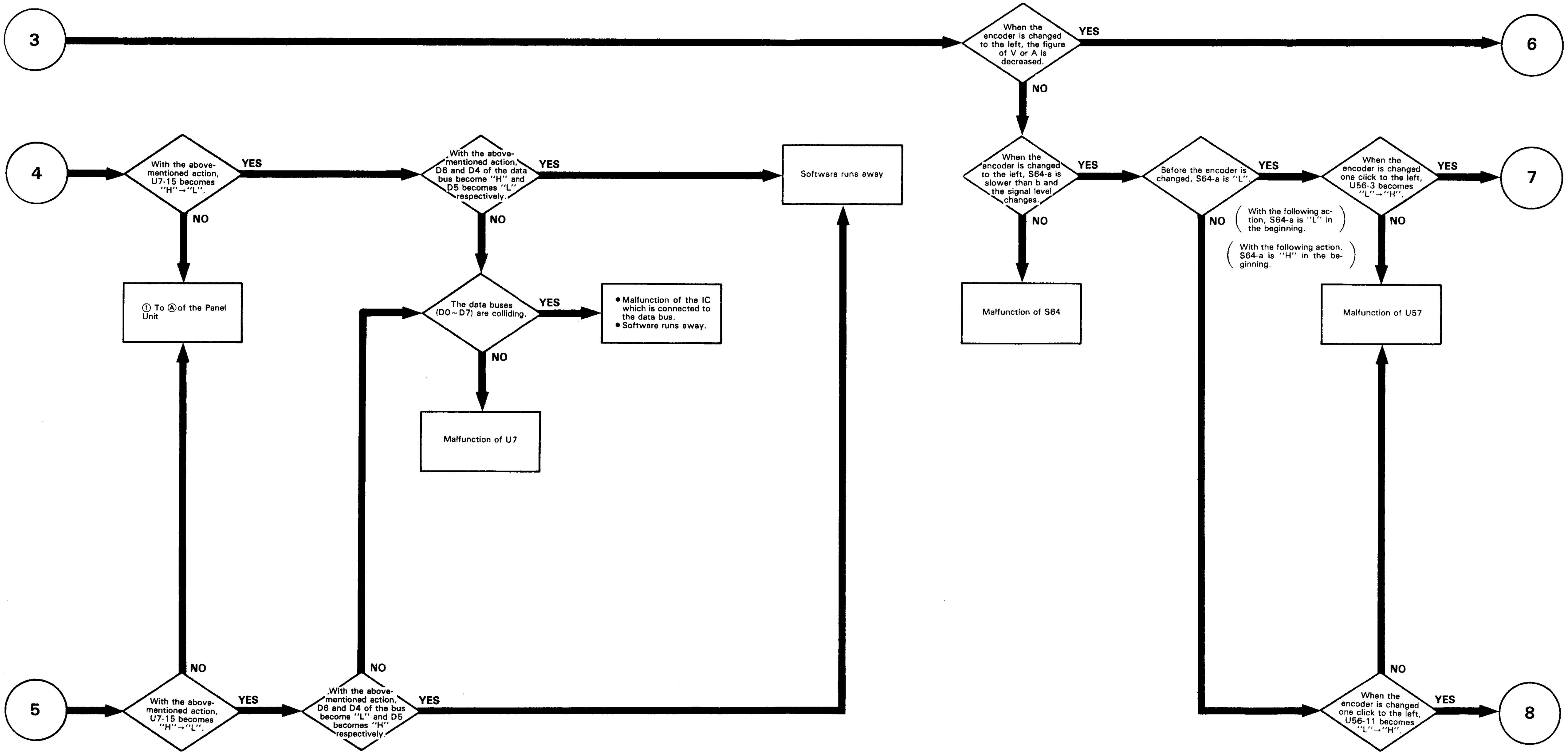
TROUBLESHOOTING


③ PANEL UNIT
Before the encoder is changed, U4-16 is "H".
YES
NO
Before the encoder is changed, U56-1 and 13 are "H".
YES
NO
Before the encoder is changed, U56-5 and 9 are "L".
YES
NO
Malfunction of of Q62, 63 and R12
①To Ⓐof the panel Unit
Malfunction of U56
When the encoder is changed, U4-16 becomes "H"→"L".
YES
NO
When the encoder is changed, either 5 or 9 of U56 becomes "L"→"H".
YES
NO
Malfunction of Q62 and 63
When the encoder is changed, the clock signal is entered into U56-3 or 6
YES
NO
After the encoder is changed, U56-1 and 13 becomes "H"→"L"→"H".
YES
NO
Malfunction of U56
① To Ⓐof the Panel Unit
When the encoder is changed, the data signal of S64-a changes.
YES
NO
Malfunction of U57
Malfunction of S64, R81 and C63
When the encoder is changed to the right, the figure of V or A increases.
YES
NO
1
When the encoder is changed to the right, S64-a is faster than b and the signal level changes.
YES
NO
2
Malfunction of S64

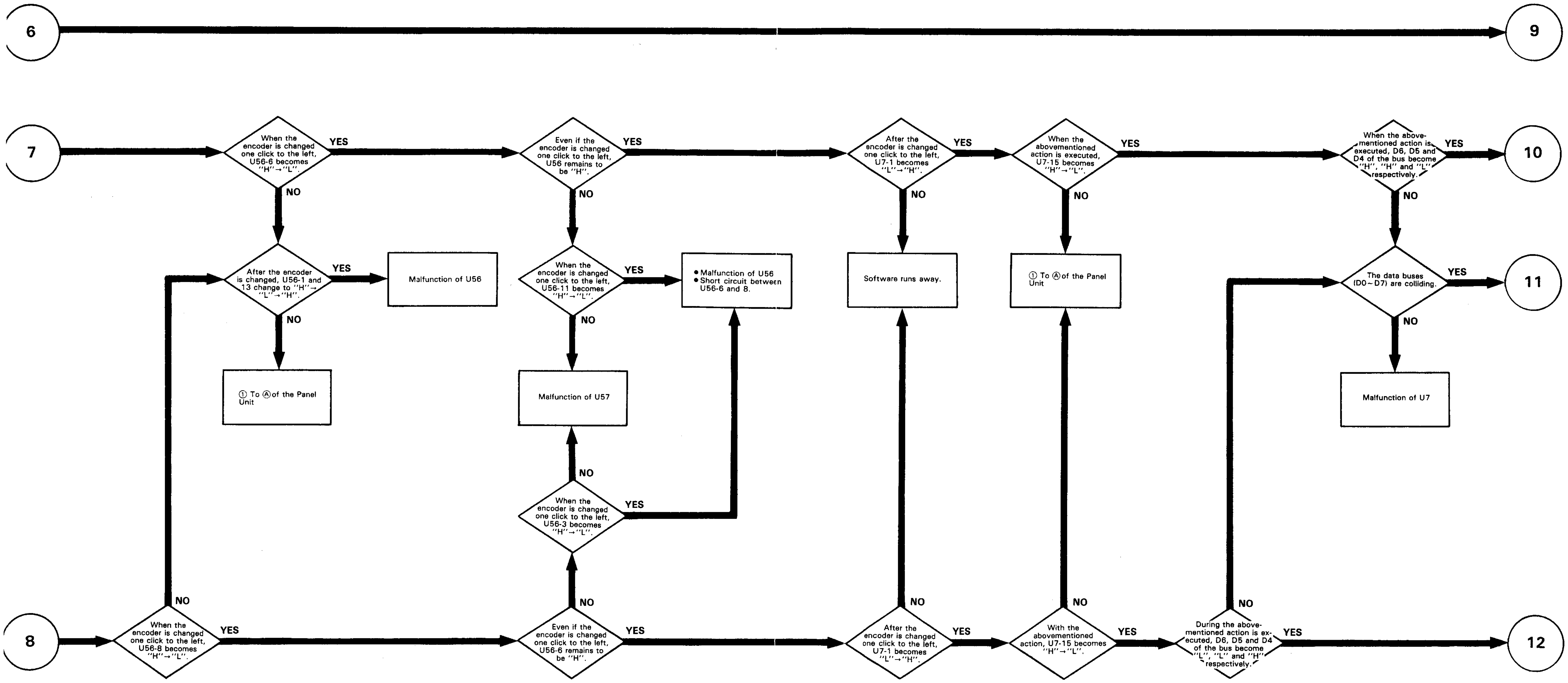
TROUBLESHOOTING


1
3
2
Before the encoder is changed, S64-a is "L".
YES
NO
(When the following action is made, S64-a shall be "L" in the beginning.)
(When the following action is made, S64-a shall be "H'0 in the beginning.)
When the encoder is changed one click to the right, U56-3 becomes "L"→"H".
YES
NO
Malfunction of U57
When the encoder is changed one click to the right, U56-6 becomes "H"→"L".
YES
NO
After the encoder is changed, U56-1 and 13 changes "H"→"H"→"L".
YES
NO
Malfunction of U56
① to Ⓐof the Panel Unit
Even if the encoder is changed one click to the right, S56-8 remain to be "H".
YES
NO
When the encoder is changed one click to the right, U56-11 becomes "H"→"L".
YES
NO
● Malfunction of U56
● Short circuit between U56-6 and 8.
Malfunction of U57
When the encoder is changed one click to the right, U56-3 becomes "H"→"L".
YES
NO
After the encoder is changed one click to the right, U7-1 becomes "L"→"H".
YES
NO
4
Software runs away.
When the encoder is changed one click to the right, U56-11 becomes "L"→"H".
YES
NO
When the encoder is changed one click to the right, S56-8 becomes "H"→"L".
YES
NO
Even if the encoder is changed one click to the right, U56-6 remains to be "H".
YES
NO
After changing the encoder one click to the right, U7-1 becomes "L"→"H".
YES
NO
5

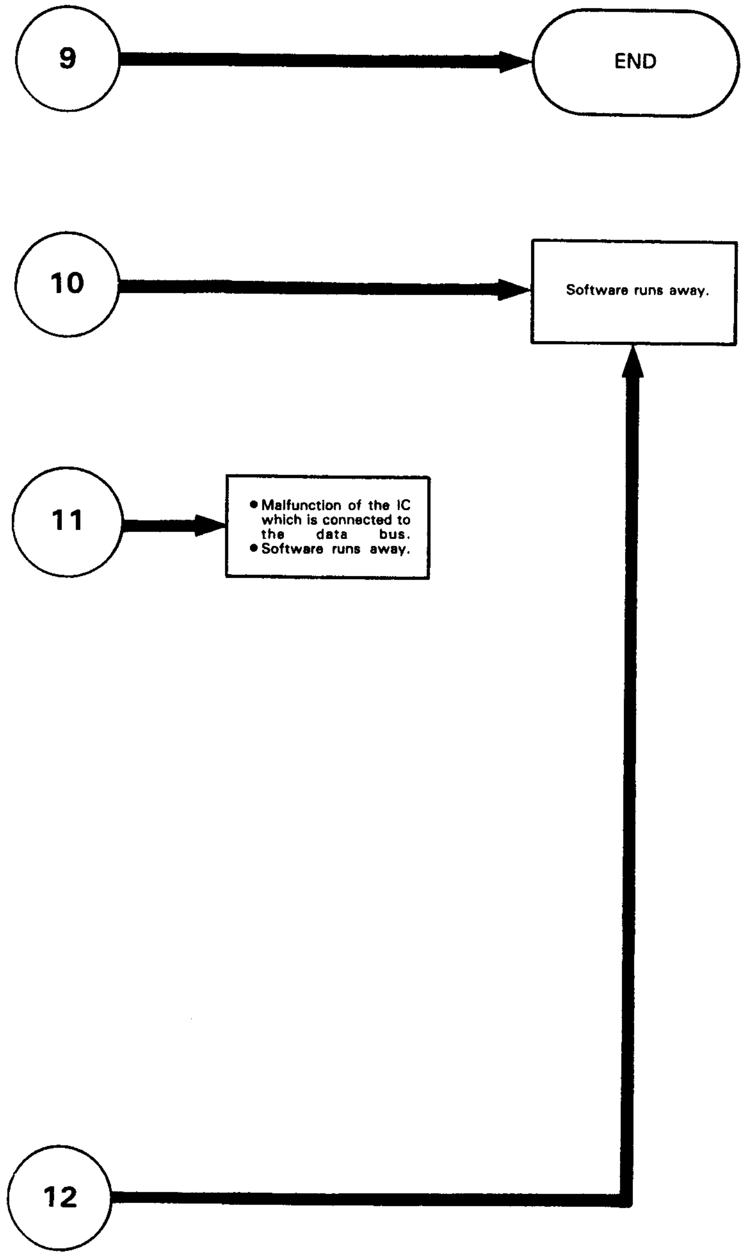
TROUBLESHOOTING


3
When the encoder is changed to the left, the figure of V or A is decreased.
YES
6
NO
4
With the above-mentioned action, U7-15 becomes "H"→"L".
YES
NO
① To Ⓐ of the Panel Unit
With the above-mentioned action, D6 and D4 of the data bus become "H" and D5 becomes "L" respectively.
YES
Software runs away
NO
The data buses (D0 ~ D7) are colliding.
YES
● Malfunction of the IC which is connected to the data bus.
● Software runs away.
NO
Malfunction of U7
When the encoder is changed to the left, S64-a is slower than b and the signal level changes.
YES
NO
Malfunction of S64
Before the encoder is changed, S64-a is "L".
YES
NO
(With the following action, S64-a is "L" in the beginning.)
(With the following action. S64-a is "H" in the beginning.)
When the encoder is changed one click to the left, U56-3 becomes "L"→"H".
YES
7
NO
Malfunction of U57
5
With the above-mentioned action, U7-15 becomes "H"→"L".
NO
YES
With the above-mentioned action, D6 and D4 of the bus become "L" and D5 becomes "H" respectively.
NO
YES
When the encoder is changed one click to the left, U56-11 becomes "L"→"H".
NO
YES
8

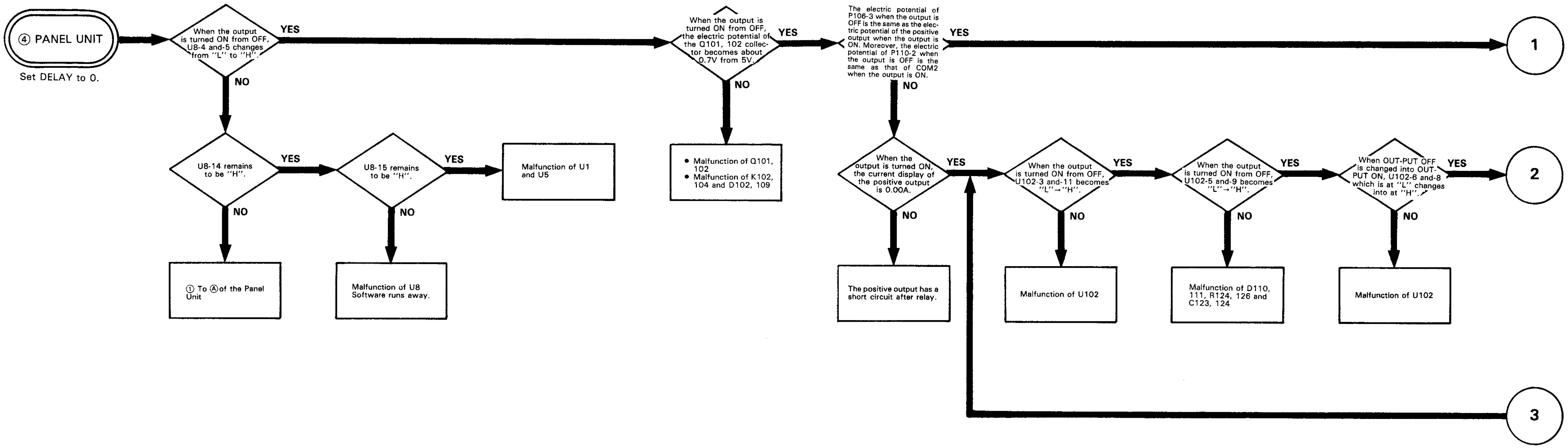
TROUBLESHOOTING


6
9
7
When the encoder is changed one click to the left, U56-6 becomes "H"→"L".
YES
NO
Even if the encoder is changed one click to the left, U56 remains to be "H".
YES
NO
After the encoder is changed one click to the left, U7-1 becomes "L"→"H".
YES
NO
When the abovementioned action is executed, U7-15 becomes "H"→"L".
YES
NO
When the abovementioned action is executed, D6, D5 and D4 of the bus become "H", "H" and "L" respectively.
YES
NO
10
After the encoder is changed, U56-1 and 13 change to "H"→"L"→"H".
YES
NO
Malfunction of U56
When the encoder is changed one click to the left, U56-11 becomes "H"→"L".
YES
NO
● Malfunction of U56
● Short circuit between U56-6 and 8.
Software runs away.
① To Ⓐ of the Panel Unit
The data buses (D0~D7) are colliding.
YES
NO
11
① To Ⓐ of the Panel Unit
Malfunction of U57
Malfunction of U7
When the encoder is changed one click to the left, U56-3 becomes "H"→"L".
YES
NO
8
When the encoder is changed one click to the left, U56-8 becomes "H"→"L".
YES
NO
Even if the encoder is changed one click to the left, U56-6 remains to be "H".
YES
NO
After the encoder is changed one click to the left, U7-1 becomes "L"→"H".
YES
NO
With the abovementioned action, U7-15 becomes "H"→"L".
YES
NO
During the abovementioned action is executed, D6, D5 and D4 of the bus become "L", "L" and "H" respectively.
YES
NO
12

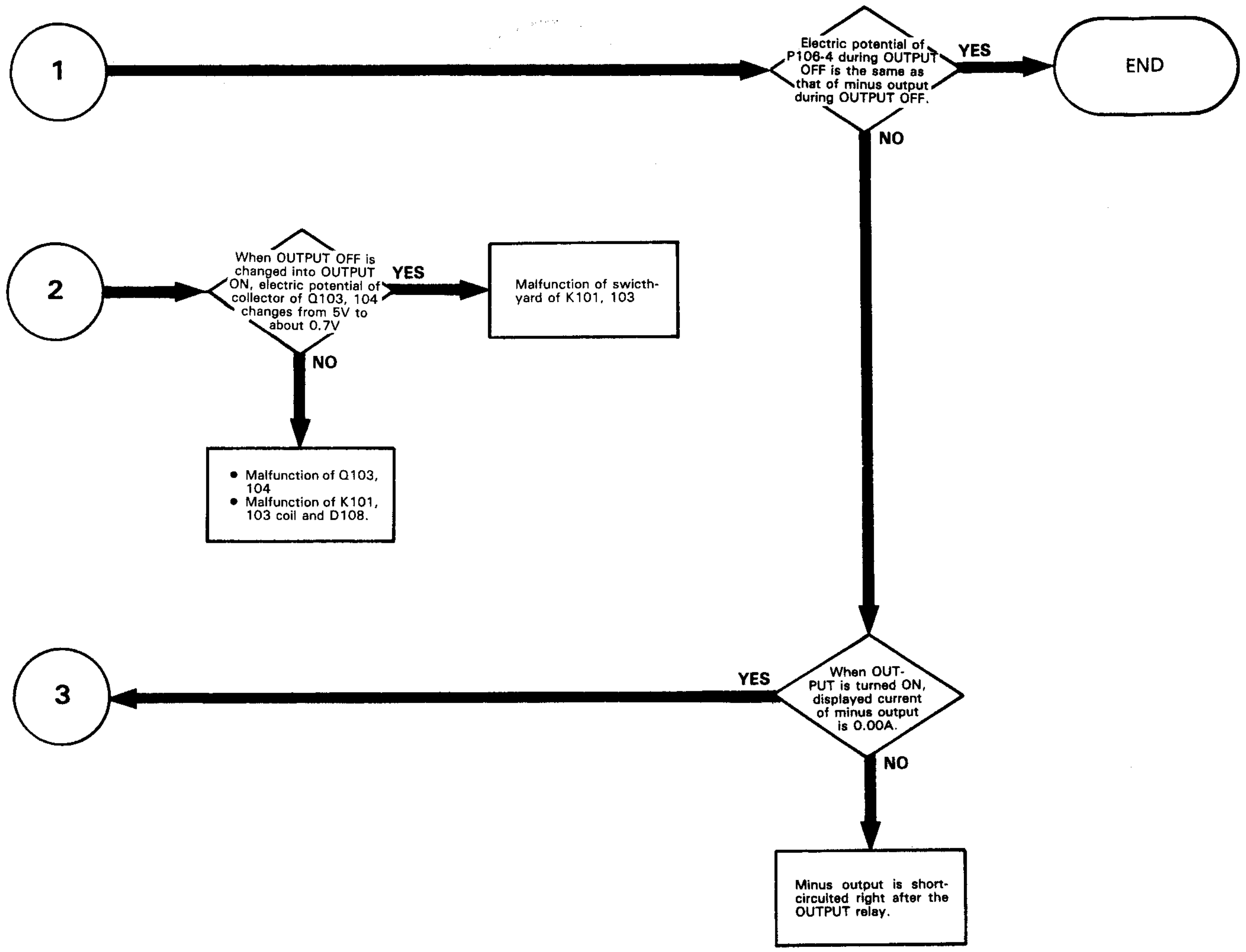
TROUBLESHOOTING


9
END
10
Software runs away.
11
• Malfunction of the IC which is connected to the data bus.
• Software runs away.
12

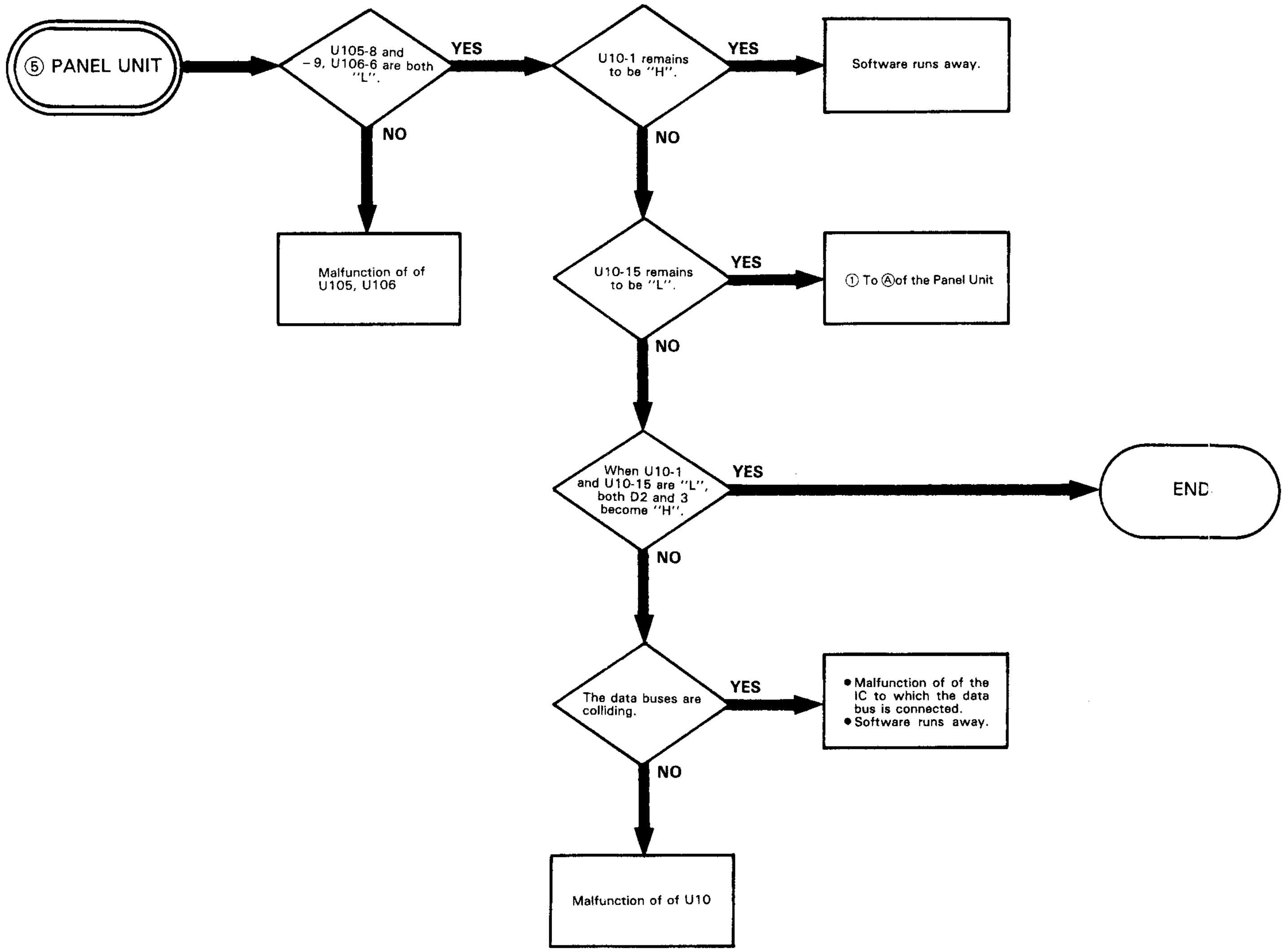
TROUBLESHOOTING


④ PANEL UNIT
Set DELAY to 0.
When the output is turned ON from OFF, U8-4 and-5 changes from "L" to "H".
YES
NO
When the output is turned ON from OFF, the electric potential of the Q101, 102 collector becomes about 0.7V from 5V.
YES
NO
The electric potential of P106-3 when the output is OFF is the same as the electric potential of the positive output when the output is ON. Moreover, the electric potential of P110-2 when the output is OFF is the same as that of COM2 when the output is ON.
YES
NO
1
U8-14 remains to be "H".
YES
NO
U8-15 remains to be "H".
YES
NO
Malfunction of U1 and U5
• Malfunction of Q101, 102
• Malfunction of K102, 104 and D102, 109
When the output is turned ON, the current display of the positive output is 0.00A.
YES
NO
When the output is turned ON from OFF, U102-3 and-11 becomes "L"→"H".
YES
NO
When the output is turned ON from OFF, U102-5 and-9 becomes "L"→"H".
YES
NO
When OUT-PUT OFF is changed into OUT-PUT ON, U102-6 and-8 which is at "L" changes into at "H".
YES
NO
2
① To Ⓐof the Panel Unit
Malfunction of U8
Software runs away.
The positive output has a short circuit after relay.
Malfunction of U102
Malfunction of D110, 111, R124, 126 and C123, 124
Malfunction of U102
3

TROUBLESHOOTING


1
Electric potential of P106-4 during OUTPUT OFF is the same as that of minus output during OUTPUT OFF.
YES
END
NO
2
When OUTPUT OFF is changed into OUTPUT ON, electric potential of collector of Q103, 104 changes from 5V to about 0.7V
YES
Malfunction of swicth-yard of K101, 103
NO
• Malfunction of Q103, 104
• Malfunction of K101, 103 coil and D108.
3
YES
When OUTPUT is turned ON, displayed current of minus output is 0.00A.
NO
Minus output is short-circulted right after the OUTPUT relay.

TROUBLESHOOTING


⑤ PANEL UNIT
U105-8 and −9, U106-6 are both "L".
YES
NO
Malfunction of of U105, U106
U10-1 remains to be "H".
YES
Software runs away.
NO
U10-15 remains to be "L".
YES
① To Ⓐof the Panel Unit
NO
When U10-1 and U10-15 are "L", both D2 and 3 become "H".
YES
END
NO
The data buses are colliding.
YES
● Malfunction of of the IC to which the data bus is connected.
● Software runs away.
NO
Malfunction of of U10

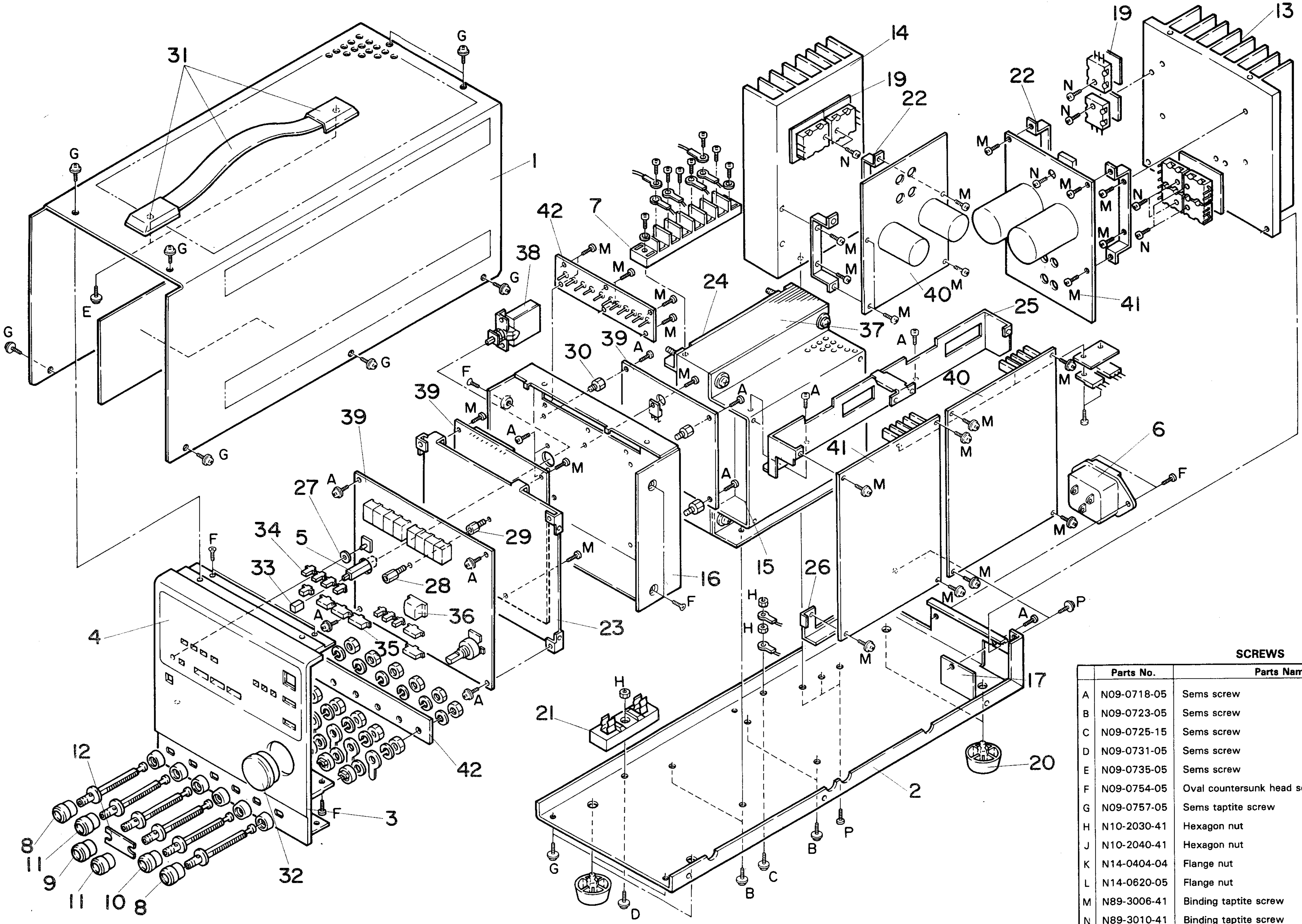
PARTS LIST

PW18-1T UNIT

(Y86-1360-00)

REF.NO	PARTS NO	NAME & DESCRIPTION
	B40-2737-24	SERIAL NO. PLATE
	B41-0835-14	RATING:AC100V 50/60HZ 176W
	B41-0836-04	RATING:AC120V~ 50/60HZ 176W
	B41-0837-04	RATING:AC220V~ 50/60HZ 160W
	B41-0838-04	RATING:AC240V~ 50/60HZ 160W
	B41-0839-04	RATING:AC120V~ 60HZ 176W
	B41-0840-14	FUSE RATING LABEL
	B42-3700-04	CAUTION LABEL
	B50-7729-10	INSTRUCTION MANUAL.JAPANESE
	B50-7730-10	INSTRUCTION MANUAL.ENGLISH
	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
	D6K20	DIODE
	E30-1644-15	BS POWER CORD
	E30-1818-05	JIS POWER CORD
	E30-1819-05	CEE POWER CORD
	E30-1820-05	UL/CSA POWER CORD
	E31-5811-15	WIRE ASS'Y:P102 TO C111.112
	E31-5812-15	WIRE ASS'Y:CPU TO PIERCED CAP.
	E31-5813-15	WIRE ASS'Y:CPU TO PIERCED CAP.
	E31-5858-15	WIRE ASS'Y:+/-18V.COM1
	E31-5859-25	WIRE ASS'Y:AC PRIMARY
	E31-5861-05	WIRE ASS'Y:P103 TO PIERCED CAP
	E31-5862-05	WIRE ASS'Y:CHANGING VOLTAGE
	E31-5863-15	WIRE ASS'Y:WITH 10P HOUSING
	E31-5864-05	WIRE ASS'Y:+6V.COM2
	E38-0109-05	WIRE ASS'Y:P9 TO P120
	F05-1524-05	FUSE(FAST BLOW) 250V 1.5A
	F51-0003-05	FUSE(SLOW BLOW) 250V 2.5A
	H01-5923-14	CARTON BOX
	H10-2846-02	FOAMED STYRENE PAD(FRONT)
	H10-2847-02	FOAMED STYRENE PAD(REAR)
	H20-1725-04	VINYL COVER
	J19-1620-05	CORD KEEP
	J61-0049-05	WIRE BAND
	NJM7805FA	IC.3-TERMINAL REGULATOR
	S10VB10	DIODE
	2SA1301(R)	TR. SI. PNP
	2SC3280(R)	TR. SI. NPN
1	A01-1226-02	CASE
2	A10-1460-12	CHASSIS
3	A20-2848-13	FRONT PANEL
4	B11-0516-03	FILTER
5	D21-0926-04	EXTENSION SHAFT
6	E18-0351-05	AC INLET 3 P
7	E20-5817-05	TERMINAL.FOR TRANSFORMER
8	E21-0670-03	TERMINAL.RED
9	E21-0671-03	TERMINAL.BLACK
10	E21-0672-03	TERMINAL.WHITE
11	E21-0673-03	TERMINAL.BULE
12	E29-0506-04	SHORTING BAR
13	F01-0877-03	HEAT SINK
14	F01-0878-03	HEAT SINK
15	F10-1626-03	SHIELD PLATE
16	F11-1240-03	SHIELD CASE
17	F15-0756-04	BLIND PLATE
18	F20-0689-05	INSULATOR
19	F20-0692-05	INSULATOR
20	J02-0323-05	LEG
21	J13-0038-05	FUSE HOLDER
22	J21-4678-04	BRACKET.FOR P.C.B
23	J21-4697-03	BRACKET
24	J21-4700-14	BRACKET
25	J21-4701-03	BRACKET
26	J21-4702-03	BRACKET
27	J30-0632-04	SPACER
28	J32-0122-04	BOSS
29	J32-0893-04	HEX. STUD
30	J32-0894-04	HEX. STUD
31	K01-0410-05	HANDLE
32	K21-0907-04	KNOB
33	K27-0509-04	PUSH BOTTON.ORANGE
34	K27-0555-04	BOTTON
35	K27-0556-04	BOTTON
36	K27-0557-04	BOTTON.RED
37	L01-9936-15	POWER TRANSFORMER
38	S40-2524-05	PUSH SWITCH (POWER)
39	X66-1110-01	PANEL UNIT
40	X73-1880-02	AMP UNIT
41	X73-1880-03	AMP UNIT
42	X81-2880-02	TERMNAL UNIT

DISASSEMBLY


31
G
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42
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B
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C
B
D

SCREWS

	Parts No.	Parts Name		Figure
A	N09-0718-05	Sems screw	(M3×6)	
B	N09-0723-05	Sems screw	(M5×10)	
C	N09-0725-15	Sems screw	(M4×12)	
D	N09-0731-05	Sems screw	(M3×12)	
E	N09-0735-05	Sems screw	(M4×6)	
F	N09-0754-05	Oval countersunk head screw	(3×8)	
G	N09-0757-05	Sems taptite screw	(3×6)	
H	N10-2030-41	Hexagon nut	(M3)	
J	N10-2040-41	Hexagon nut	(M4)	
K	N14-0404-04	Flange nut	(M3)	
L	N14-0620-05	Flange nut	(M4)	
M	N89-3006-41	Binding taptite screw	(3×6)	
N	N89-3010-41	Binding taptite screw	(3×10)	
P	N09-0739-05	Sems taptite screw	(3×8)	

PARTS LIST

PW18-1T PANEL UNIT

(X66-1110-01)

REF.NO	PARTS NO	NAME & DESCRIPTION
	B42-3704-04	LABEL,FOR ROM
	E02-0143-05	SEMICONDUCTOR SOCKET 28P
	E31-5841-05	WIRE ASS'Y: JW101 TO U1
	E31-5842-05	WIRE ASS'Y: L3 TO J3
	E31-5853-15	WIRE ASS'Y: FOR D107
	E31-5856-15	WIRE ASS'Y: P104 TO P20
	E31-5857-15	WIRE ASS'Y: P105 TO P20
	E31-5870-05	WIRE ASS'Y: JW1 TO P52
	E31-5872-05	WIRE ASS'Y: JW2 TO P52
	F15-0744-05	BLIND PLATE
	J25-5394-02	PCB (UNMOUNTED)
	R92-1061-05	JUMPING RES. ZERO OHM (5MM)
C001	CE04EW1A471M	CAP. ELECTRO 470 20% 10V
C002	CE04EW1A471M	CAP. ELECTRO 470 20% 10V
C003	CC45CH1H101J	CAP. CERAMIC 100P 5% 50V
C004	CC45CH1H101J	CAP. CERAMIC 100P 5% 50V
C005	CE04EW1H2R2M	CAP. ELECTRO 2.2 20% 50V
C006	CF92V1H473J	CAP. POLYESTER 0.047 5% 50V
C007	C91-1310-05	CAP. DOUBLE 0.1F -20/+80% 5.5V
C008	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C009	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C010	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C011	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C012	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C013	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C014	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C015	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C016	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C017	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C018	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C019	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C051	CE04EW1A221M	CAP. ELECTRO 220 20% 10V
C052	CE04EW1A221M	CAP. ELECTRO 220 20% 10V
C053	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C054	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C055	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C056	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C057	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C058	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C059	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C060	CC45CH1H101J	CAP. CERAMIC 100P 5% 50V
C061	CC45CH1H101J	CAP. CERAMIC 100P 5% 50V
C062	CK45B1H103K	CAP. CERAMIC 0.01 10% 50V
C101	C90-3008-05	CAP. CERAMIC 3900 20% 16V
C102	CE04EW1A471M	CAP. ELECTRO 470 20% 10V
C103	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C104	CE04EW1A101M	CAP. ELECTRO 100 20% 10V
C105	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C106	CE04EW1A101M	CAP. ELECTRO 100 20% 10V
C107	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C108	CF92V1H153J	CAP. POLYESTER 0.015 5% 50V
C109	CF92V1H153J	CAP. POLYESTER 0.015 5% 50V
C123	CF92V1H104J	CAP. POLYESTER 0.1 5% 50V
C124	CF92V1H104J	CAP. POLYESTER 0.1 5% 50V
C125	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C126	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
D001	1S1587	DIODE
D002	1S1587	DIODE
D003	1SS132	DIODE
D051	GL-8D03D	LED,RED:7 SEGMENT
D052	GL-8D03D	LED,RED:7 SEGMENT
D053	GL-8D03D	LED,RED:7 SEGMENT
D054	GL-8D03D	LED,RED:7 SEGMENT
D055	GL-8D03D	LED,RED:7 SEGMENT
D056	GL-8D03D	LED,RED:7 SEGMENT
D057	GL-8D03D	LED,RED:7 SEGMENT
D058	GL-8D03D	LED,RED:7 SEGMENT
D059	B30-0972-05	LED,RED
D060	B30-0973-05	LED,GREEN
D061	B30-0972-05	LED,RED
D062	B30-0973-05	LED,GREEN
D063	B30-0973-05	LED,GREEN
D064	B30-0973-05	LED,GREEN
D065	B30-0972-05	LED,RED
D066	B30-0972-05	LED,RED
D067	B30-0972-05	LED,RED
D068	B30-0973-05	LED,GREEN
D069	B30-0973-05	LED,GREEN
D070	B30-0973-05	LED,GREEN
D071	B30-0973-05	LED,GREEN
D072	B30-0973-05	LED,GREEN
D073	B30-0973-05	LED,GREEN
D101	S1VB10	DIODE
D102	1SS132	DIODE
D103	1SS132	DIODE
D104	S3V10	DIODE
D105	S3V10	DIODE
D108	1SS132	DIODE
D109	1SS132	DIODE
D110	1SS132	DIODE
D111	1SS132	DIODE
K101	S51-2508-05	RELAY
K102	S51-2511-05	RELAY
K103	S51-2508-05	RELAY
K104	S51-1529-05	RELAY
L001	L40-4701-03	FERRI INDUCTOR 47UH 10%
L051	L40-4701-03	FERRI INDUCTOR 47UH 10%
P001	E40-3237-05	PIN CONNECTOR 2P
P004	E40-5067-05	PIN CONNECTOR 10P
P051	E40-3237-05	PIN CONNECTOR 2P
P101	E40-3237-05	PIN CONNECTOR 2P
P102	E40-3239-05	PIN CONNECTOR 4P
P103	E40-5067-05	PIN CONNECTOR 10P
P104	E40-5067-05	PIN CONNECTOR 10P
P105	E40-5066-05	
P106	E40-3239-05	PIN CONNECTOR 4P
P107	NO USE	
P108	E40-4248-05	PIN CONNECTOR 2P
P109	E40-3911-05	PIN CONNECTOR 3P
P110	E40-3239-05	PIN CONNECTOR 4P
P116	E40-3237-05	PIN CONNECTOR 2P
P120	E23-0581-05	LUG TERMINAL
P121	E23-0581-05	LUG TERMINAL
Q001	2SC2785(F)	TR. SI. NPN
Q002	2SC2785(F)	TR. SI. NPN
Q051	2SC2785(F)	TR. SI. NPN
Q052	2SC2785(F)	TR. SI. NPN
Q053	2SC2785(F)	TR. SI. NPN
Q054	2SC2785(F)	TR. SI. NPN
Q055	2SC2785(F)	TR. SI. NPN
Q056	2SC2785(F)	TR. SI. NPN
Q057	2SC2785(F)	TR. SI. NPN
Q058	2SC2785(F)	TR. SI. NPN
Q059	2SC2785(F)	TR. SI. NPN
Q060	2SC2785(F)	TR. SI. NPN
Q061	NO USE	
Q062	2SC2785(F)	TR. SI. NPN
Q063	2SC2785(F)	TR. SI. NPN
Q101	2SC1815(Y)	TR. SI. NPN
Q102	2SC1815(Y)	TR. SI. NPN
Q103	2SC1815(Y)	TR. SI. NPN
Q104	2SC1815(Y)	TR. SI. NPN
R001	RD14BB2C105J	RES. CARBON 1M 5% 1/6W
R002	NO USE	
R003	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R004	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R005	RD14BB2C273J	RES. CARBON 27K 5% 1/6W
R006	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R007	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R008	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
R011	R90-0612-05	RES. NETWORK 4.7K X 8
R012	R90-0612-05	RES. NETWORK 4.7K X 8
R051	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R052	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R053	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R054	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R055	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION
R056	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R057	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R058	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R059	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R060	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R061	RD14BB2C151J	RES. CARBON 150 5% 1/6W
R062	RD14BB2C151J	RES. CARBON 150 5% 1/6W
R063	RD14BB2C151J	RES. CARBON 150 5% 1/6W
R064	RD14BB2C151J	RES. CARBON 150 5% 1/6W
R065	RD14BB2C151J	RES. CARBON 150 5% 1/6W
R066	RD14BB2C151J	RES. CARBON 150 5% 1/6W
R067	RD14BB2C151J	RES. CARBON 150 5% 1/6W
R068	RD14BB2C151J	RES. CARBON 150 5% 1/6W
R069	RD14BB2C151J	RES. CARBON 150 5% 1/6W
R070	RD14BB2C151J	RES. CARBON 150 5% 1/6W
R071	RD14BB2C151J	RES. CARBON 150 5% 1/6W
R072	RD14BB2C151J	RES. CARBON 150 5% 1/6W
R073	RD14BB2C151J	RES. CARBON 150 5% 1/6W
R074	RD14BB2C151J	RES. CARBON 150 5% 1/6W
R075	RD14BB2C151J	RES. CARBON 150 5% 1/6W
R076	RD14BB2C151J	RES. CARBON 150 5% 1/6W
R079	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R080	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R081	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R082	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R083	RD14BB2C104J	RES. CARBON 100K 5% 1/6W
R084	RD14BB2C104J	RES. CARBON 100K 5% 1/6W
R085	R90-0612-05	RES. NETWORK 4.7K X 8
R101	RD14BB2C221J	RES. CARBON 220 5% 1/6W
R102	RD14BB2C221J	RES. CARBON 220 5% 1/6W
R103	RD14BB2C221J	RES. CARBON 220 5% 1/6W
R104	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R105	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R106	RD14BB2C431J	RES. CARBON 430 5% 1/6W
R107	RD14BB2C431J	RES. CARBON 430 5% 1/6W
R108	RD14BB2C431J	RES. CARBON 430 5% 1/6W
R109	RD14BB2C431J	RES. CARBON 430 5% 1/6W
R110	RD14BB2C431J	RES. CARBON 430 5% 1/6W
R111	RD14BB2C431J	RES. CARBON 430 5% 1/6W
R112	RD14BB2C431J	RES. CARBON 430 5% 1/6W
R113	RD14BB2C431J	RES. CARBON 430 5% 1/6W
R114	RD14BB2C431J	RES. CARBON 430 5% 1/6W
R115	RD14BB2C431J	RES. CARBON 430 5% 1/6W
R116	RD14BB2C431J	RES. CARBON 430 5% 1/6W
R122	RD14BB2E220J	RES. CARBON 22 5% 1/4W
R123	RD14BB2E220J	RES. CARBON 22 5% 1/4W
R124	RD14BB2C154J	RES. CARBON 150K 5% 1/6W
R125	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R126	RD14BB2C154J	RES. CARBON 150K 5% 1/6W
R127	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R128	NO USE	
R129	RD14BB2E220J	RES. CARBON 22 5% 1/4W
R136	RD14BB2C751J	RES. CARBON 750 5% 1/6W
S051	S50-1426-05	TACT SWITCH
S052	S50-1426-05	TACT SWITCH
S053	S50-1426-05	TACT SWITCH
S054	S50-1426-05	TACT SWITCH
S055	S50-1426-05	TACT SWITCH
S056	S50-1426-05	TACT SWITCH
S057	S50-1426-05	TACT SWITCH
S058	S50-0503-05	TACT SWITCH
S059	S50-1426-05	TACT SWITCH
S060	S50-1426-05	TACT SWITCH
S061	S50-1426-05	TACT SWITCH
S062	S50-1426-05	TACT SWITCH
S063	S50-1426-05	TACT SWITCH
S064	W02-0388-05	ROTARY ENCORDER
S065	S50-1426-05	TACT SWITCH
S066	S50-1426-05	TACT SWITCH
U001	TC74HCU04AP	IC,HEX INVERTER
U002	T93-0694-04	IC,PROGRAM ROM
U003	HM6264ALP-15L	IC,C-MOS STATIC RAM
U004	LH0080A	IC,CPU
U005	MB3773P-G	IC,RESET
U006	TC74HC139AP	IC,DUAL 2 TO 4 DEMULTIPLEXERS
U007	TC74HC257AP	IC,QUAD 2-DATA SELECT./MPX(3-S
U008	TC74HC259AP	IC,8-BIT ADDRESSABLE LATCHES
U009	TC74HC139AP	IC,DUAL 2 TO 4 DEMULTIPLEXERS
U010	TC74HC257AP	IC,QUAD 2-DATA SELECT./MPX(3-S
U011	TC74HC74AP	IC,DUAL D-FFS
U012	NJM555D	IC,TIMER
U013	TC74HC32AP	IC,QUAD 2 INPUT OR
U051	TC9191P	IC,DRIVER
U052	TC74HC541AP	IC,OCTAL 3-STATE BUFFER
U053	TC74HC374AP	IC,OCTAL 3-STATE D-FFS
U054	TC9191P	IC,DRIVER
U055	TC74HC30AP	IC,8 INPUT NAND
U056	TC74HC74AP	IC,DUAL D-FFS
U057	TC74HC14AP	IC,HEX SCHMITT TRIGGER INVERT.
U102	TC74HC125AP	IC,QUAD 3 STATE BUS BUFFERS
U103	PC837	IC,PHOTO COUPLER
U104	PC837	IC,PHOTO COUPLER
U105	PC837	IC,PHOTO COUPLER
U106	PC827	IC,PHOTO COUPLER
X001	L78-0104-05	RESONATOR

PW18-1T AMP UNIT

(X73-1880-02)

REF.NO	PARTS NO	NAME & DESCRIPTION
	E38-0018-05	WIRE ASS'Y:JW2 TO Q15
	E38-0019-05	WIRE ASS'Y:JW3 TO Q16
	E38-0103-05	WIRE ASS'Y:P17,18,22 TO
	F02-0520-05	HEAT SINK
	F20-0647-05	INSULATOR
	J25-5262-32	PCB (UNMOUNTED)
	N09-0626-04	SCREW,SEMS M3X10
	N19-0191-05	WASHER NONMETAL
C001	C90-3009-05	CAP. ELECTRO 2700 20% 25V
C002	C90-3009-05	CAP. ELECTRO 2700 20% 25V
C003	CE04EW1C331M	CAP. ELECTRO 330 20% 16V
C004	CE04EW1C221M	CAP. ELECTRO 220 20% 16V
C005	CE04EW1A470M	CAP. ELECTRO 47 20% 10V
C006	CE04EW1A101M	CAP. ELECTRO 100 20% 10V
C007	CE04EW1A101M	CAP. ELECTRO 100 20% 10V
C008	CE04EW1H2R2M	CAP. ELECTRO 2.2 20% 50V
C009	CE04EW1H2R2M	CAP. ELECTRO 2.2 20% 50V
C010	CE04EW1C100M	CAP. ELECTRO 10 20% 16V
C011	CE04EW1C100M	CAP. ELECTRO 10 20% 16V
C012	CE04EW1C100M	CAP. ELECTRO 10 20% 16V
C013	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C014	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C015	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C016	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C017	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C018	NO USE	
C019	CF92V1H105J	CAP. POLYESTER 1 5% 50V
C020	CF92V1H474J	CAP. POLYESTER 0.47 5% 50V
C021	CF92V1H105J	CAP. POLYESTER 1 5% 50V
C022	CF92V1H474J	CAP. POLYESTER 0.47 5% 50V
C023	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C024	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C025	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C026	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C027	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C028	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C029	CF92V1H474J	CAP. POLYESTER 0.47 5% 50V
C030	CF92V1H474J	CAP. POLYESTER 0.47 5% 50V
C031	C90-3014-05	CAP. ELECTRO 4700 20% 50V
C032	C90-3014-05	CAP. ELECTRO 4700 20% 50V
C033	CF93AN2E104K	CAP. METAL FILM 0.1 10% 250V
C034	CF93AN2E104K	CAP. METAL FILM 0.1 10% 250V
C041	CE04EW1E470M	CAP. ELECTRO 47 20% 25V
C042	NO USE	
C043	CE04EW1E470M	CAP. ELECTRO 47 20% 25V
D001	S1VB10	DIODE
D002	MTZ13JB	DIODE, ZENER 12.88V
D003	MTZ13JB	DIODE, ZENER 12.88V
D004	MTZ5.1JB	DIODE, ZENER 5.07V
D005	MTZ9.1JC	DIODE, ZENER 9.6V
D006	1SZ59	DIODE, ZENER 6.5V
D007	MTZ5.1JA	DIODE, ZENER 4.94V
D008	1SS132	DIODE
D009	1SS132	DIODE
D010	1SS132	DIODE
D011	1SS132	DIODE
D012	1SS132	DIODE
D013	1SS132	DIODE
D014	1SS132	DIODE
D015	1SS132	DIODE
D016	1SS132	DIODE

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION			
D017	1SS132	DIODE			
D018	1SS132	DIODE			
D023	DSA1A2	DIODE			
D024	DSA1A2	DIODE			
L001	L40-4701-03	FERRI INDUCTOR	47UH	10%	
P001	E23-0581-05	LUG TERMINAL			
P002	E23-0581-05	LUG TERMINAL			
P003	E23-0581-05	LUG TERMINAL			
P011	E40-3238-05	PIN CONNECTOR	3P		
P012	NO USE				
P013	E40-3237-05	PIN CONNECTOR	2P		
P014	E40-4248-05	PIN CONNECTOR	2P		
P015	E40-4248-05	PIN CONNECTOR	2P		
P016	NO USE				
P017	E40-4248-05	PIN CONNECTOR	2P		
P018	E40-4248-05	PIN CONNECTOR	2P		
P019	NO USE				
P020	E40-5067-05	PIN CONNECTOR	10P		
P021	NO USE				
P022	E40-3237-05	PIN CONNECTOR	2P		
P023	E23-0401-05	PIN TERMINAL			
P024	E23-0401-05	PIN TERMINAL			
Q001	2SA1111(Q)	TR. SI, PNP			
Q002	2SC2591(Q)	TR. SI, NPN			
Q003	2SA1209(R)	TR. SI, PNP			
Q004	2SC2911(R)	TR. SI, NPN			
R001	RD14BB2E361J	RES. CARBON	360	5%	1/4W
R002	RD14BB2E361J	RES. CARBON	360	5%	1/4W
R003	RD14BB2C431J	RES. CARBON	430	5%	1/6W
R004	RD14BB2C431J	RES. CARBON	430	5%	1/6W
R005	RD14BB2C512J	RES. CARBON	5.1K	5%	1/6W
R006	RN14BK2C1002F	RES. METAL FILM	10K	1%	1/6W
R007	RN14BK2C1002F	RES. METAL FILM	10K	1%	1/6W
R008	RN14BK2C6801F	RES. METAL FILM	6.8K	1%	1/6W
R009	RN14BK2C5101F	RES. METAL FILM	5.1K	1%	1/6W
R010	RD14BB2C512J	RES. CARBON	5.1K	5%	1/6W
R011	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R012	RD14BB2C910J	RES. CARBON	91	5%	1/6W
R013	RD14BB2C241J	RES. CARBON	240	5%	1/6W
R014	NO USE				
R015	RN14BK2C6201F	RES. METAL FILM	6.2K	1%	1/6W
R016	RN14BK2C1002F	RES. METAL FILM	10K	1%	1/6W
R017	RN14BK2C9530F	RES. METAL FILM	953	1%	1/6W
R018	RN14BK2C9530F	RES. METAL FILM	953	1%	1/6W
R019	RD14BB2C112J	RES. CARBON	1.1K	5%	1/6W
R020	RN14BK2C8200F	RES. METAL FILM	820	1%	1/6W
R021	RN14BK2C3001F	RES. METAL FILM	3K	1%	1/6W
R022	RN14BK2C1500F	RES. METAL FILM	150	1%	1/6W
R028	R92-1465-05	RES. COMPLEX	2K,10K		
R029	NO USE				
R030	R92-1465-05	RES. COMPLEX	2K,10K		
R031	RD14BB2C361J	RES. CARBON	360	5%	1/6W
R032	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R033	RD14BB2C361J	RES. CARBON	360	5%	1/6W
R034	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R035	RN14BC2B3001CKW	RES. METAL FILM	3K	0.25%	1/8W
R036	RN14BC2B1202CKW	RES. METAL FILM	12K	0.25%	1/8W
R037	RN14BC2B3001CKW	RES. METAL FILM	3K	0.25%	1/8W
R038	RN14BC2B1202CKW	RES. METAL FILM	12K	0.25%	1/8W
R039	RD14BB2C512J	RES. CARBON	5.1K	5%	1/6W
R040	RD14BB2C153J	RES. CARBON	15K	5%	1/6W
R041	RD14BB2C512J	RES. CARBON	5.1K	5%	1/6W
R042	NO USE				
R043	RD14BB2E152J	RES. CARBON	1.5K	5%	1/4W
R044	RD14BB2E152J	RES. CARBON	1.5K	5%	1/4W
R045	RD14BB2C162J	RES. CARBON	1.6K	5%	1/6W
R046	RD14BB2C162J	RES. CARBON	1.6K	5%	1/6W
R047	R92-0150-05	JUMPING RES.	ZERO OHM(10MM)		
R048	R92-1061-05	JUMPING RES.	ZERO OHM (5MM)		
R051	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R052	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R053	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R054	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R055	RD14BB2C181J	RES. CARBON	180	5%	1/6W
R056	RD14BB2C181J	RES. CARBON	180	5%	1/6W
R057	R92-1456-05	RES. CEMENT	1	5%	3W
R058	R92-1456-05	RES. CEMENT	1	5%	3W
R059	RD14BB2C122J	RES. CARBON	1.2K	5%	1/6W
R060	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R061	RD14BB2C512J	RES. CARBON	5.1K	5%	1/6W
R062	RD14BB2C513J	RES. CARBON	51K	5%	1/6W
R063	RD14BB2C361J	RES. CARBON	360	5%	1/6W
R064	RN14BK2C1602F	RES. METAL FILM	16K	1%	1/6W
R065	RN14BK2C1801F	RES. METAL FILM	1.8K	1%	1/6W
R066	RN14BK2C1602F	RES. METAL FILM	16K	1%	1/6W
R067	RN14BK2C1801F	RES. METAL FILM	1.8K	1%	1/6W
R068	RN14BK2C1004F	RES. METAL FILM	1M	1%	1/6W
R069	RN14BK2C1004F	RES. METAL FILM	1M	1%	1/6W
R070	RN14BK2E2004F	RES. METAL FILM	2M	1%	1/4W
R071	RN14BK2E2004F	RES. METAL FILM	2M	1%	1/4W
R072	RD14BB2C511J	RES. CARBON	510	5%	1/6W
R073	RD14BB2C511J	RES. CARBON	510	5%	1/6W
R074	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R075	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R157	RD14DB3AR82J	RES. CARBON	0.82	5%	1W
R158	NO USE				
R159	RD14DB2H2R2J	RES. CARBON	2.2	5%	1/2W
R160	RD14BB2C131J	RES. CARBON	130	5%	1/6W
R161	NO USE				
R162	RD14BB2C301J	RES. CARBON	300	5%	1/6W
R163	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R164	RD14DB3AR82J	RES. CARBON	0.82	5%	1W
R165	NO USE				
R166	RD14DB2H2R2J	RES. CARBON	2.2	5%	1/2W
R167	RD14BB2C131J	RES. CARBON	130	5%	1/6W
R168	NO USE				
R169	RD14BB2C301J	RES. CARBON	300	5%	1/6W
R170	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R174	R92-1460-05	RES. CARBON	680	5%	1W
R175	R92-1460-05	RES. CARBON	680	5%	1W
TP001	E23-0401-05	PIN TERMINAL			
U001	NJM7805FA	IC,3-TERMINAL REGULATOR			
U002	NJM4558D	IC,DUAL OP AMP			
U003	TC4094BP	IC,8-STAGE SHIFT/STORE REGISTE			
U004	TC4094BP	IC,8-STAGE SHIFT/STORE REGISTE			
U005	TC4094BP	IC,8-STAGE SHIFT/STORE REGISTE			
U006	AM6012DC	IC,12-BIT D/A CONVERTER			
U007	HD14053BP	IC,TRIPLE 2CH ANALOG MPX/DE-MP			
U008	HD14052BP	IC,DUAL ANALOG MULTIPLEXER			
U009	NJM4558D	IC,DUAL OP AMP			
U010	NJM072BD	IC,JFET INPUT OP AMP			
U011	NJM072BD	IC,JFET INPUT OP AMP			
U012	NJM4558D	IC,DUAL OP AMP			
U013	NJM4558D	IC,DUAL OP AMP			
U014	NJM4560D	IC,OP AMP			
U015	PC619	IC,PHOTO COUPLER			
U016	PC619	IC,PHOTO COUPLER			
U017	TC74HC11AP	IC,TRIPLE 3 INPUT AND			
VR001	R12-0556-05	RES. SEMI FIXED	100 B		
VR002	R12-0556-05	RES. SEMI FIXED	100 B		
VR003	R12-0541-05	RES. SEMI FIXED	100 B		
VR004	R12-0541-05	RES. SEMI FIXED	100 B		

PW18-1T AMP UNIT

(X73-1880-03)

REF.NO	PARTS NO	NAME & DESCRIPTION			
	E23-0401-05	PIN TERMINAL			
	E38-0104-05	WIRE ASS'Y;P22 TO JW1.P4,5 TO			
	F02-0520-05	HEAT SINK			
	F20-0647-05	INSULATOR			
	J25-5262-32	PCB (UNMOUNTED)			
	N09-0626-04	SCREW,SEMS	M3X10		
	N19-0191-05	WASHER NONMETAL			
C001	C90-3009-05	CAP. ELECTRO	2700	20%	25V
C002	C90-3009-05	CAP. ELECTRO	2700	20%	25V
C003	CE04EW1C331M	CAP. ELECTRO	330	20%	16V
C004	CE04EW1C221M	CAP. ELECTRO	220	20%	16V
C005	CE04EW1A470M	CAP. ELECTRO	47	20%	10V
C006	CE04EW1A101M	CAP. ELECTRO	100	20%	10V
C007	CE04EW1A101M	CAP. ELECTRO	100	20%	10V
C008	NO USE				
C009	CE04EW1H2R2M	CAP. ELECTRO	2.2	20%	50V
C010	CE04EW1C100M	CAP. ELECTRO	10	20%	16V
C011	CE04EW1C100M	CAP. ELECTRO	10	20%	16V
C012	CE04EW1C100M	CAP. ELECTRO	10	20%	16V
C013	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C014	C90-0298-05	CAP. CERAMIC	0.1	20%	12V

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION			
C015	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C016	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C017	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C021	CF92V1H105J	CAP. POLYESTER	1	5%	50V
C022	CF92V1H474J	CAP. POLYESTER	0.47	5%	50V
C023	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C024	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C025	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C026	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C027	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C028	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C029	CF92V1H474J	CAP. POLYESTER	0.47	5%	50V
C030	NO USE				
C031	C90-3015-05	CAP. ELECTRO	22000	20%	25V
C032	C90-3015-05	CAP. ELECTRO	22000	20%	25V
C043	CE04EW1E470M	CAP. ELECTRO	47	20%	25V
C060	CF93AN2E104K	CAP. METAL FILM	0.1	10%	250V
D001	S1V810	DIODE			
D002	MTZ13JB	DIODE, ZENER	12.88V		
D003	MTZ13JB	DIODE, ZENER	12.88V		
D004	MTZ5.1JB	DIODE, ZENER	5.07V		
D005	MTZ9.1JC	DIODE, ZENER	9.6V		
D006	1SZ59	DIODE, ZENER	6.5V		
D007	MTZ5.1JA	DIODE, ZENER	4.94V		
D010	1SS132	DIODE			
D011	1SS132	DIODE			
D014	1SS132	DIODE			
D015	1SS132	DIODE			
D016	NO USE				
D017	1SS132	DIODE			
D018	1SS132	DIODE			
D024	DSA1A2	DIODE			
L001	L40-4701-03	FERRI INDUCTOR	47UH	10%	
P001	E23-0581-05	LUG TERMINAL			
P002	NO USE				
P003	E23-0581-05	LUG TERMINAL			
P004	NO USE				
P005	E23-0581-05	LUG TERMINAL			
P006	E23-0581-05	LUG TERMINAL			
P007	E23-0581-05	LUG TERMINAL			
P008	NO USE				
P009	E23-0581-05	LUG TERMINAL			
P010	NO USE				
P011	E40-3238-05	PIN CONNECTOR	3P		
P012	NO USE				
P013	E40-3237-05	PIN CONNECTOR	2P		
P017	E40-4248-05	PIN CONNECTOR	2P		
P020	E40-5067-05	PIN CONNECTOR	10P		
P021	NO USE				
P022	E40-3237-05	PIN CONNECTOR	2P		
Q001	2SA1111(Q)	TR. SI. PNP			
Q002	2SC2591(Q)	TR. SI. NPN			
Q003	NO USE				
Q004	2SC2911(R)	TR. SI. NPN			
R001	RD14BB2E361J	RES. CARBON	360	5%	1/4W
R002	RD14BB2E361J	RES. CARBON	360	5%	1/4W
R003	RD14BB2C431J	RES. CARBON	430	5%	1/6W
R004	RD14BB2C431J	RES. CARBON	430	5%	1/6W
R005	RD14BB2C512J	RES. CARBON	5.1K	5%	1/6W
R006	RN14BK2C1002F	RES. METAL FILM	10K	1%	1/6W
R007	RN14BK2C1002F	RES. METAL FILM	10K	1%	1/6W
R008	RN14BK2C6801F	RES. METAL FILM	6.8K	1%	1/6W
R009	RN14BK2C5101F	RES. METAL FILM	5.1K	1%	1/6W
R010	RD14BB2C512J	RES. CARBON	5.1K	5%	1/6W
R011	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R012	RD14BB2C910J	RES. CARBON	91	5%	1/6W
R013	RD14BB2C241J	RES. CARBON	240	5%	1/6W
R014	NO USE				
R015	RN14BK2C6201F	RES. METAL FILM	6.2K	1%	1/6W
R016	RN14BK2C1002F	RES. METAL FILM	10K	1%	1/6W
R017	RN14BK2C9530F	RES. METAL FILM	953	1%	1/6W
R018	RN14BK2C9530F	RES. METAL FILM	953	1%	1/6W
R019	RD14BB2C112J	RES. CARBON	1.1K	5%	1/6W
R020	RN14BK2C8200F	RES. METAL FILM	820	1%	1/6W
R021	RN14BK2C3001F	RES. METAL FILM	3K	1%	1/6W
R022	RN14BK2C1500F	RES. METAL FILM	150	1%	1/6W
R030	R92-1465-05	RES. COMPLEX	2K,10K		
R033	RD14BB2C361J	RES. CARBON	360	5%	1/6W
R034	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R037	RN14BC2B3001CKW	RES. METAL FILM	3K	0.25%	1/8W
R038	RN14BC2B1202CKW	RES. METAL FILM	12K	0.25%	1/8W
R039	RD14BB2C512J	RES. CARBON	5.1K	5%	1/6W
R040	RD14BB2C153J	RES. CARBON	15K	5%	1/6W
R041	RD14BB2C512J	RES. CARBON	5.1K	5%	1/6W
R044	RD14BB2E152J	RES. CARBON	1.5K	5%	1/4W
R045	NO USE				
R046	RD14BB2C162J	RES. CARBON	1.6K	5%	1/6W
R047	R92-1061-05	JUMPING RES.	ZERO OHM (5MM)		
R048	R92-0150-05	JUMPING RES.	ZERO OHM(10MM)		
R053	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R054	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R055	NO USE				
R056	RD14BB2C181J	RES. CARBON	180	5%	1/6W
R057	R92-1462-05				
R058	R92-1462-05				
R059	RD14BB2C122J	RES. CARBON	1.2K	5%	1/6W
R060	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R061	RD14BB2C512J	RES. CARBON	5.1K	5%	1/6W
R062	RD14BB2C513J	RES. CARBON	51K	5%	1/6W
R063	RD14BB2C361J	RES. CARBON	360	5%	1/6W
R064	RN14BK2C1602F	RES. METAL FILM	16K	1%	1/6W
R065	RN14BK2C1801F	RES. METAL FILM	1.8K	1%	1/6W
R066	RN14BK2C1602F	RES. METAL FILM	16K	1%	1/6W
R067	RN14BK2C1801F	RES. METAL FILM	1.8K	1%	1/6W
R068	RN14BK2C1004F	RES. METAL FILM	1M	1%	1/6W
R069	RN14BK2C1004F	RES. METAL FILM	1M	1%	1/6W
R070	RN14BK2E2004F	RES. METAL FILM	2M	1%	1/4W
R071	RN14BK2E2004F	RES. METAL FILM	2M	1%	1/4W
R072	NO USE				
R073	RD14BB2C511J	RES. CARBON	510	5%	1/6W
R074	NO USE				
R075	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R157	RD14DB3DR43J	RES. CARBON	0.43	5%	2W
R158	RD14DB3DR43J	RES. CARBON	0.43	5%	2W
R159	NO USE				
R160	RD14BB2E101J	RES. CARBON	100	5%	1/4W
R161	RD14BB2E101J	RES. CARBON	100	5%	1/4W
R162	NO USE				
R163	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R164	RD14DB3DR43J	RES. CARBON	0.43	5%	2W
R165	RD14DB3DR43J	RES. CARBON	0.43	5%	2W
R166	NO USE				
R167	RD14BB2E101J	RES. CARBON	100	5%	1/4W
R168	RD14BB2E101J	RES. CARBON	100	5%	1/4W
R169	NO USE				
R170	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R175	RD14BB2E271J	RES. CARBON	270	5%	1/4W
R186	R92-1462-05				
R215	R92-0150-05	JUMPING RES.	ZERO OHM(10MM)		
U001	NJM7805FA	IC,3-TERMINAL REGULATOR			
U002	NJM4558D	IC,DUAL OP AMP			
U003	TC4094BP	IC,8-STAGE SHIFT/STORE REGISTE			
U004	TC4094BP	IC,8-STAGE SHIFT/STORE REGISTE			
U005	TC4094BP	IC,8-STAGE SHIFT/STORE REGISTE			
U006	AM6012DC	IC,12-BIT D/A CONVERTER			
U007	HD14053BP	IC,TRIPLE 2CH ANALOG MPX/DE-MP			
U008	HD14052BP	IC,DUAL ANALOG MULTIPLEXER			
U009	NJM4558D	IC,DUAL OP AMP			
U010	NO USE				
U011	NJM072BD	IC,JFET INPUT OP AMP			
U012	NO USE				
U013	NJM4558D	IC,DUAL OP AMP			
U014	NJM4560D	IC,OP AMP			
U015	NO USE				
U016	PC619	IC,PHOTO COUPLER			
U017	TC74HC11AP	IC,TRIPLE 3 INPUT AND			
VR001	R12-0556-05	RES. SEMI FIXED 100 B			
VR002	R12-0556-05	RES. SEMI FIXED 100 B			
VR003	NO USE				
VR004	R12-0541-05	RES. SEMI FIXED 100 B			

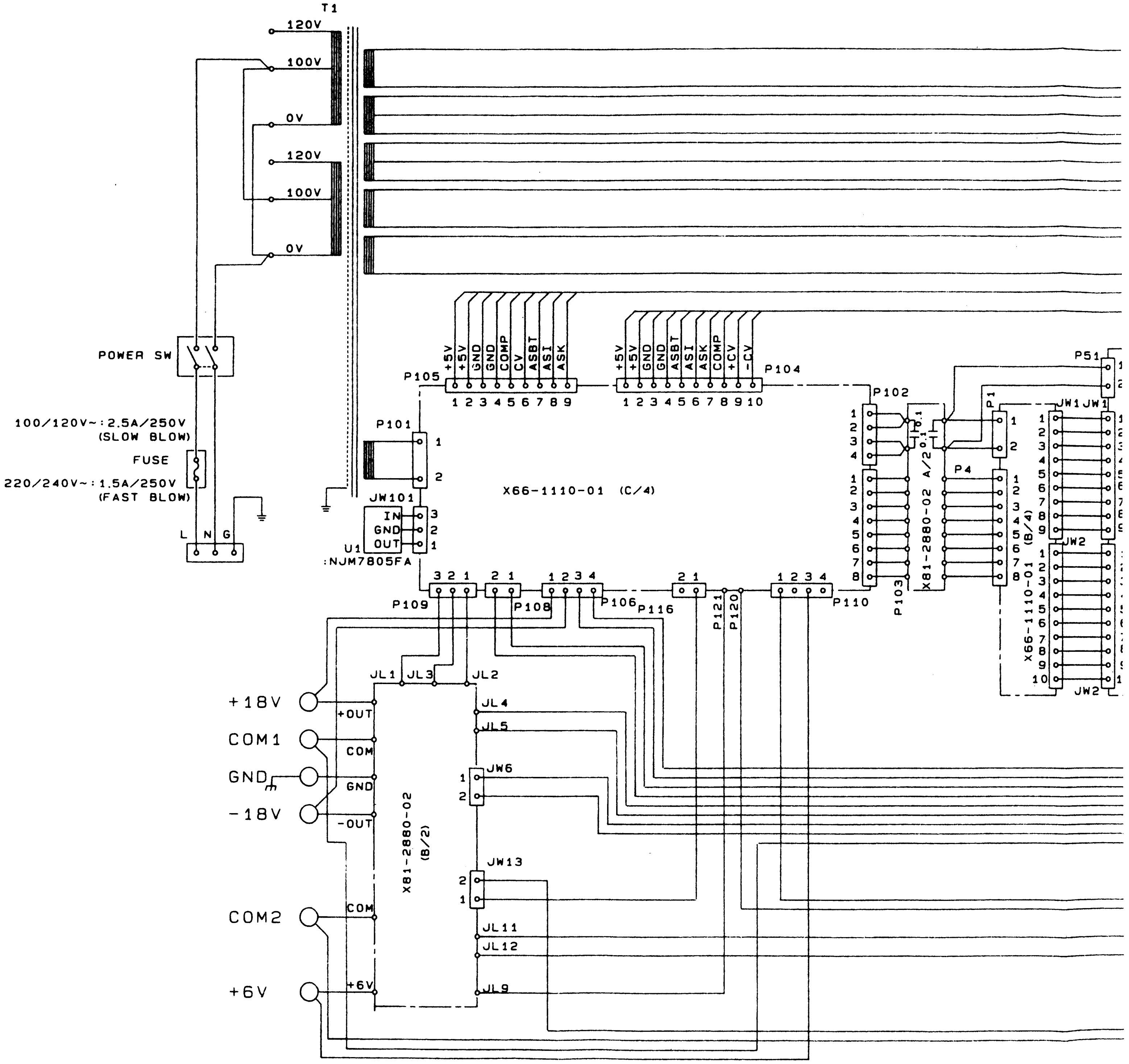
PARTS LIST

PW18-1T TERMINAL UNIT

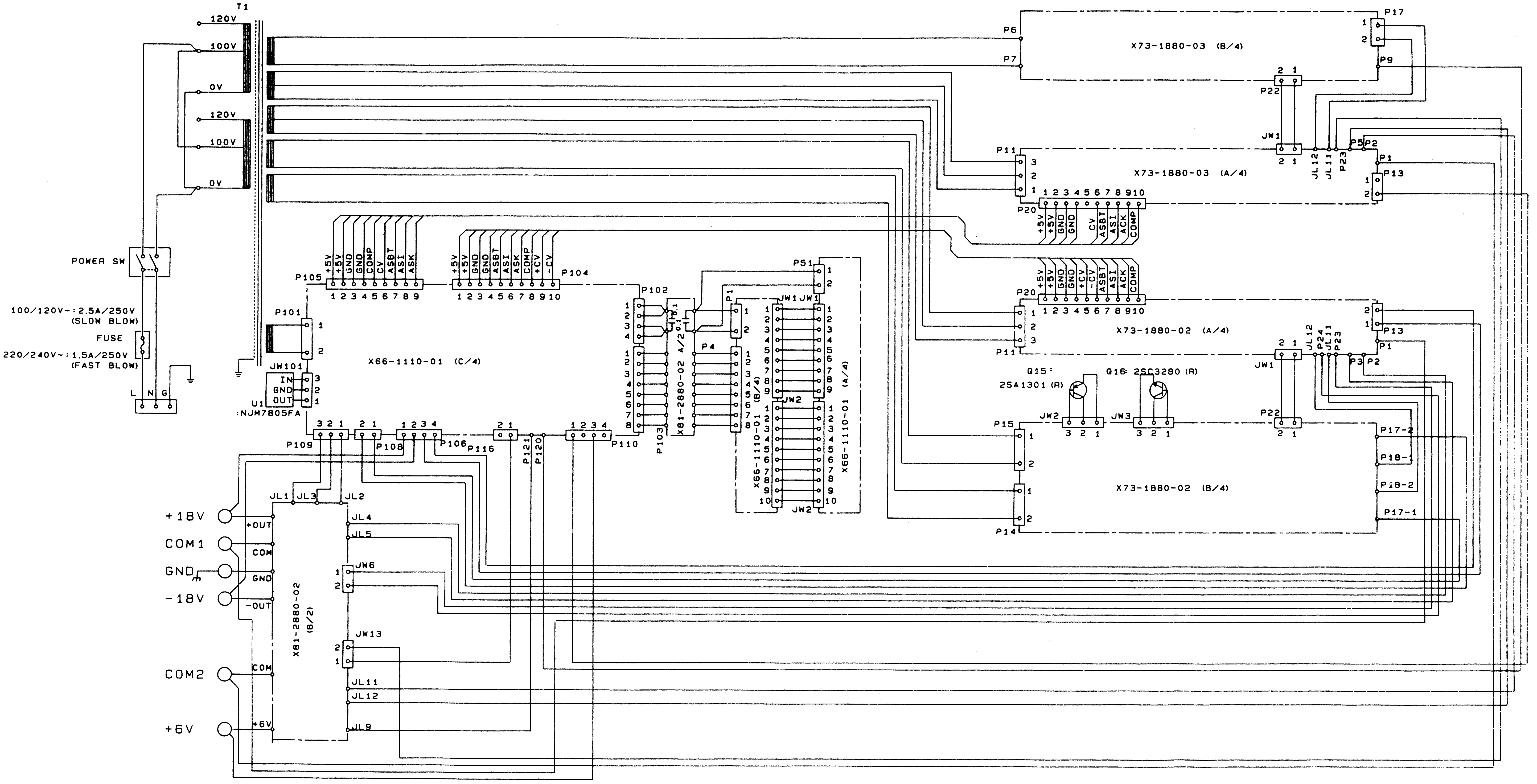
(X81-2880-02)

REF.NO	PARTS NO	NAME & DESCRIPTION			
	J73-0019-03	PCB (UNMOUNTED)			
C001	CE04EW1E471M	CAP. ELECTRO	470	20%	25V
C002	CE04EW1E471M	CAP. ELECTRO	470	20%	25V
C003	NO USE				
C004	CE04EW1C102M	CAP. ELECTRO	1000	20%	16V
C111	C91-0579-05	CAP. CERAMIC	1000P		500V
C112	C91-0579-05	CAP. CERAMIC	1000P		500V
C113	C91-0579-05	CAP. CERAMIC	1000P		500V
C114	C91-0579-05	CAP. CERAMIC	1000P		500V
C115	C91-0579-05	CAP. CERAMIC	1000P		500V
C116	C91-0579-05	CAP. CERAMIC	1000P		500V
C117	C91-0579-05	CAP. CERAMIC	1000P		500V
C118	C91-0579-05	CAP. CERAMIC	1000P		500V
C119	C91-0579-05	CAP. CERAMIC	1000P		500V
C120	C91-0579-05	CAP. CERAMIC	1000P		500V
C121	C91-0579-05	CAP. CERAMIC	1000P		500V
C122	C91-0579-05	CAP. CERAMIC	1000P		500V
R001	RD14DB3D301J	RES. CARBON	300	5%	2W
R002	RD14DB3D301J	RES. CARBON	300	5%	2W
R003	NO USE				
R004	R92-1061-05	JUMPING RES.	ZERO OHM (5MM)		
R005	R92-1061-05	JUMPING RES.	ZERO OHM (5MM)		
R006	RD14BB2E301J	RES. CARBON	300	5%	1/4W

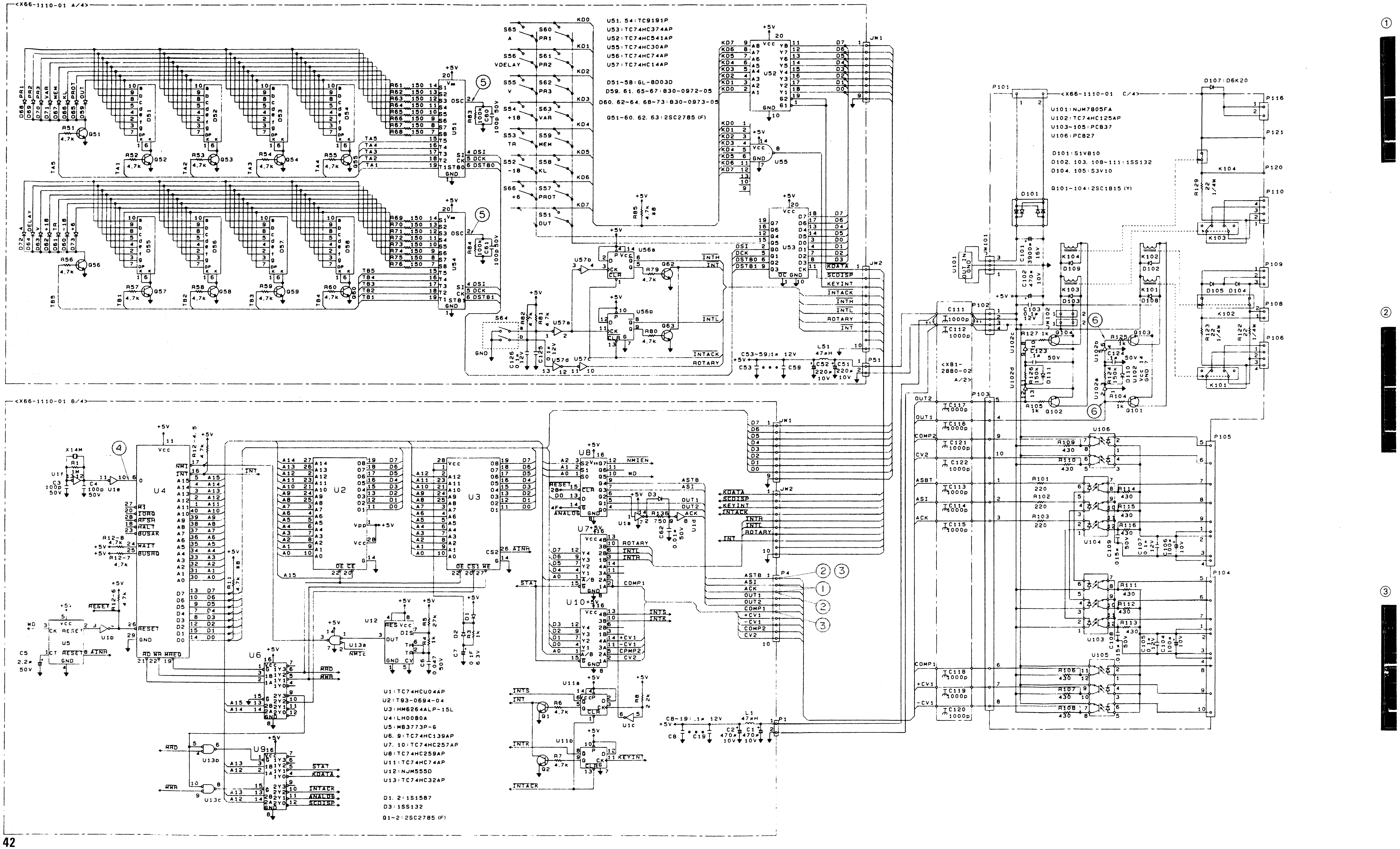
SCHEMATIC DIAGRAM


T1
120V
100V
0V
120V
100V
0V
POWER SW
100/120V~:2.5A/250V
(SLOW BLOW)
FUSE
220/240V~:1.5A/250V
(FAST BLOW)
L N G
P105
+5V +5V GND GND COMP CV ASBT ASI ASK
1 2 3 4 5 6 7 8 9
+5V +5V GND GND ASBT ASI ASK COMP +CV -CV
1 2 3 4 5 6 7 8 9 10
P104
P101
JW101
IN
GND
OUT
U1
:NJM7805FA
X66-1110-01 (C/4)
P102
P103
X81-2880-02 A/2
0.1
0.1
P1
P4
P51
JW1
JW2
X66-1110-01 (B/4)
P109
P108
P106
P116
P121
P120
P110
JL1
JL3
JL2
JL4
JL5
JW6
JW13
JL11
JL12
JL9
+OUT
COM
GND
-OUT
COM
+6V
X81-2880-02 (B/2)
+18V
COM1
GND
-18V
COM2
+6V

SCHEMATIC DIAGRAM

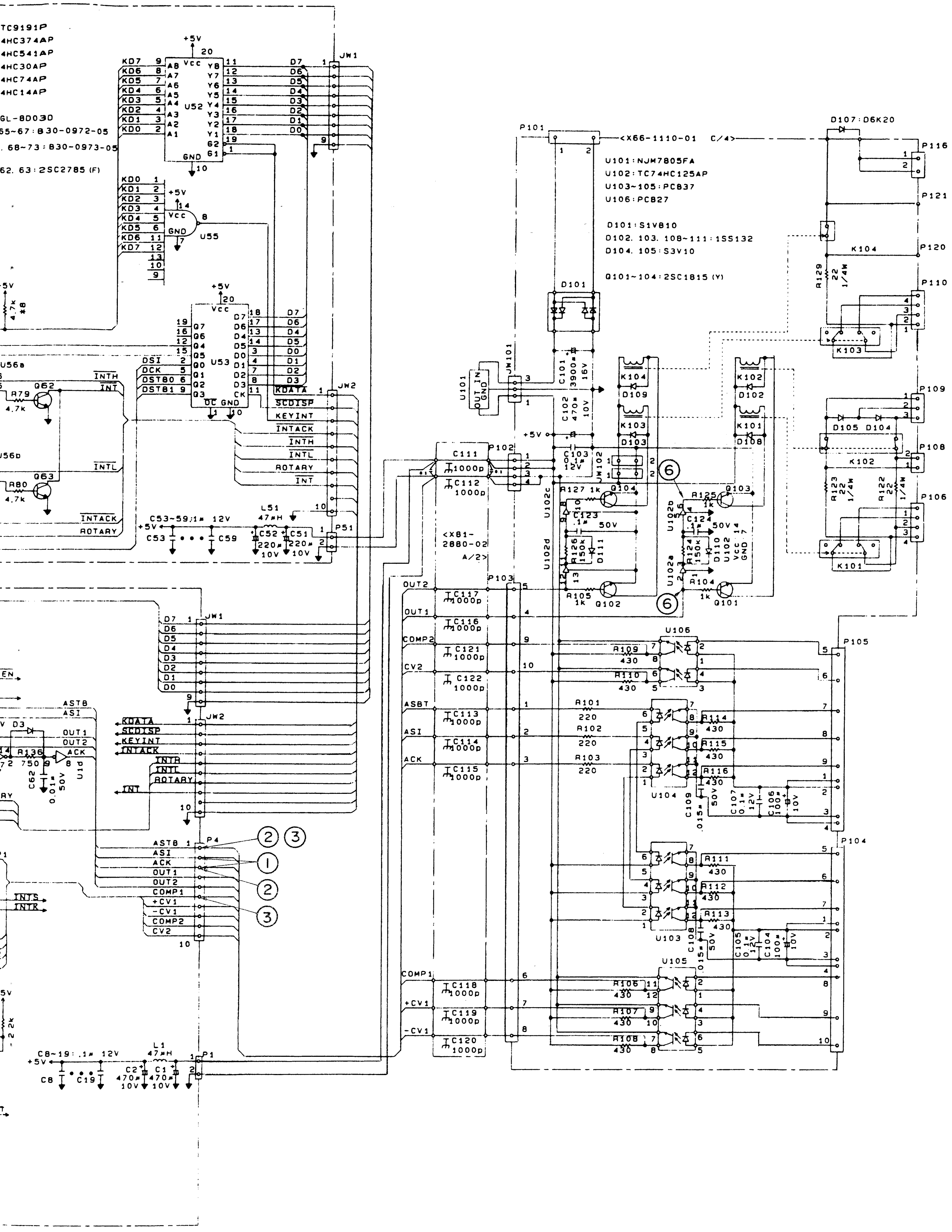

T1
120V
100V
0V
120V
100V
0V
POWER SW
100/120V~: 2.5A/250V
(SLOW BLOW)
FUSE
220/240V~: 1.5A/250V
(FAST BLOW)
L N G
P101
JW101
IN
GND
OUT
U1
: NJM7805FA
P105
+5V +5V GND GND COMP CV ASBT ASI ASK
1 2 3 4 5 6 7 8 9
+5V +5V GND GND ASBT ASI ASK COMP +CV -CV
1 2 3 4 5 6 7 8 9 10
P104
X66-1110-01 (C/4)
P102
P103
X81-2880-02 A/2
0.1
P1
P4
X81-2880-02 (B/4)
P51
JW1
JW2
X66-1110-01 (B/4)
X66-1110-01 (A/4)
P109
P108
P106
P116
P121
P120
P110
JL1 JL3 JL2
JL4
JL5
JW6
JW13
JL11
JL12
JL9
+OUT
COM
GND
-OUT
COM
+6V
X81-2880-02 (B/2)
+18V
COM1
GND
-18V
COM2
+6V
P6
P7
X73-1880-03 (B/4)
P17
P9
P22
JW1
P11
X73-1880-03 (A/4)
JL12
JL11
P23
P5
P2
P1
P13
P20
1 2 3 4 5 6 7 8 9 10
+5V +5V GND GND CV ASBT ASI ACK COMP
+5V +5V GND GND +CV -CV ASBT ASI ACK COMP
X73-1880-02 (A/4)
P24
P3
Q15:
2SA1301 (R)
Q16: 2SC3280 (R)
JW2
JW3
P15
P14
X73-1880-02 (B/4)
P17-2
P18-1
P18-2
P17-1

SCHEMATIC DIAGRAM



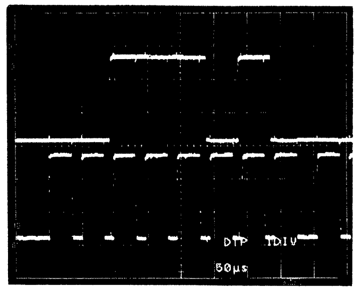
<X66-1110-01 A/4>
<X66-1110-01 B/4>
<X66-1110-01 C/4>
<X81-2880-02 A/2>
U51, 54: TC9191P
U53: TC74HC374AP
U52: TC74HC541AP
U55: TC74HC30AP
U56: TC74HC74AP
U57: TC74HC14AP
D51~58: GL-8D03D
D59. 61. 65~67: 830-0972-05
D60. 62~64. 68~73: 830-0973-05
Q51~60. 62. 63: 2SC2785 (F)
U101: NJM7805FA
U102: TC74HC125AP
U103~105: PC837
U106: PC827
D101: S1V810
D102. 103. 108~111: 1SS132
D104. 105: S3V10
Q101~104: 2SC1815 (Y)
U1: TC74HCU04AP
U2: T93-0694-04
U3: HM6264ALP-15L
U4: LH0080A
U5: MB3773P-6
U6. 9: TC74HC139AP
U7. 10: TC74HC257AP
U8: TC74HC259AP
U11: TC74HC74AP
U12: NJM555D
U13: TC74HC32AP
D1. 2: 1S1587
D3: 1SS132
Q1~2: 2SC2785 (F)
D107: D6K20
S65 A
S60 PR1
S56 VDELAY
S61 PR2
S55 V
S62 PR3
S54 +18
S63 VAR
S53 TR
S59 MEM
S52 -18
S58 KL
S66 +6
S57 PROT
S51 OUT
S64
KD0
KD1
KD2
KD3
KD4
KD5
KD6
KD7
U51
U52
U53
U54
U55
U56a
U56b
U57a
U57b
U57c
U57d
U4
U2
U3
U5
U6
U7
U8
U9
U10
U11a
U11b
U12
U13a
U13b
U13c
U1a
U1b
U1c
U1d
U1e
U1f
U101
U102a
U102b
U102c
U102d
U103
U104
U105
U106
X14M
JW1
JW2
P51
P1
P4
P101
P102
P103
P104
P105
P106
P108
P109
P110
P116
P120
P121
K101
K102
K103
K104
L1 47μH
L51 47μH
C8~19: .1μ 12V
C53~59: .1μ 12V
TA1
TA2
TA3
TA4
TA5
TB1
TB2
TB3
TB4
TB5
DSI
DCK
DSTB0
DSTB1
KDATA
SCDISP
KEYINT
INTACK
INTH
INTL
ROTARY
INT
NMIEN
MD
ASTB
ASI
ACK
OUT1
OUT2
COMP1
COMP2
+CV1
-CV1
CV2
AINH
STAT
ANALOG
RESET
MRD
MWR
INTS
INTR
+5V
①
②
③
④
⑤
⑥

C DIAGRAM


TC9191P
4HC374AP
4HC541AP
4HC30AP
4HC74AP
4HC14AP
GL-8D030
55~67 : 830-0972-05
. 68~73 : 830-0973-05
62, 63 : 2SC2785 (F)
U52
U55
U53
U56a
U56b
Q62
Q63
R79 4.7k
R80 4.7k
JW1
JW2
P51
P4
P1
L51 47μH
C53~59 ; .1μ 12V
C52 220μ 10V
C51 220μ 10V
C8~19 : .1μ 12V
L1 47μH
C2 470μ 10V
C1 470μ 10V
KDATA
SCDISP
KEYINT
INTACK
INTH
INTL
ROTARY
INT
ASTB
ASI
ACK
OUT1
OUT2
COMP1
+CV1
-CV1
COMP2
CV2
D3
R136 750
C62 0.01μ 50V
P101
<X66-1110-01 C/4>
U101 : NJM7805FA
U102 : TC74HC125AP
U103~105 : PC837
U106 : PC827
D101 : S1VB10
D102, 103, 108~111 : 1SS132
D104, 105 : S3V10
Q101~104 : 2SC1815 (Y)
D107 : D6K20
D101
C101 3900μ 16V
C102 470μ 10V
C103 0.1μ 12V
U101 OUT IN GND
JW101
P102
P103
C111 1000p
C112 1000p
<X81-2880-02 A/2>
K101
K102
K103
K104
D109
D108
R127 1k
R125 1k
R105 1k
R104 1k
R126 150k
R124 150k
C123 .1μ 50V
C124 .1μ 50V
Q101
Q102
Q103
Q104
U102a
U102b
U102c
U102d
⑥
P116
P121
P120
P110
P109
P108
P106
P105
P104
R129 22 1/4W
R123 22 1/4W
R122 22 1/4W
D105
D104
U106
U104
U103
U105
R109 430
R110 430
R101 220
R102 220
R103 220
R114 430
R115 430
R116 430
R111 430
R112 430
R113 430
R106 430
R107 430
R108 430
C113 1000p
C114 1000p
C115 1000p
C116 1000p
C117 1000p
C118 1000p
C119 1000p
C120 1000p
C121 1000p
C122 1000p
C105 0.1μ 12V
C106 100μ 10V
C107 0.1μ 12V
C108 .15μ 50V
C109 .15μ 50V
C104 100μ 10V
② ③
①
②
③

WAVEFORM

①

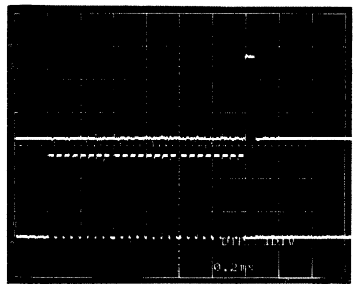


P4-2 Waveform
In case of X73-1880-02, it takes DATA Waveform.

P4-3 Waveform
In case of X73-1880-02, it takes STROBE Waveform.

50μs/diV

②

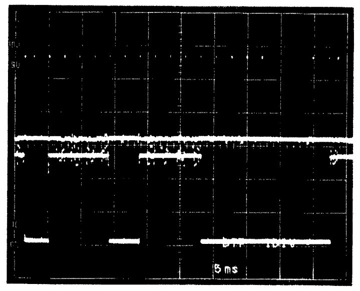


P4-1 Waveform
In case of X73-1880-02, it takes CLOCK Waveform.

P4-3 Waveform

0.2ms/diV

③

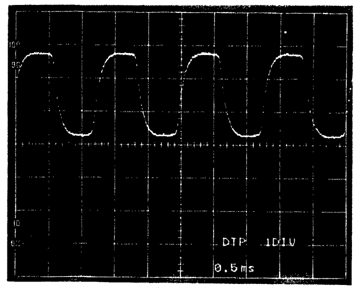


P4-1 Waveform

P4-6 Waveform
In case of X73-1880-02, it takes P20-10 Waveform.

5ms/diV

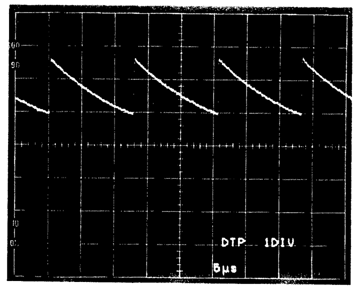
④



U4-6 Waveform, CPU Clock Waveform

0.5ms/diV

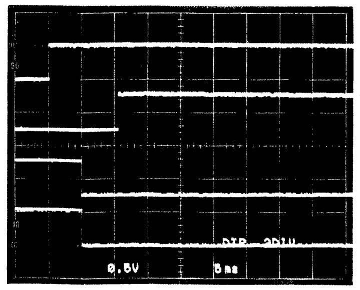
⑤



U51 and 52-2 Waveform

5μs/diV

⑥



U102-2 Waveform (for K101 disturbance)

U102-6 Waveform (for K102 disturbance)

During OUTPUT is ON

U102-7 Waveform (for K101 disturbance)

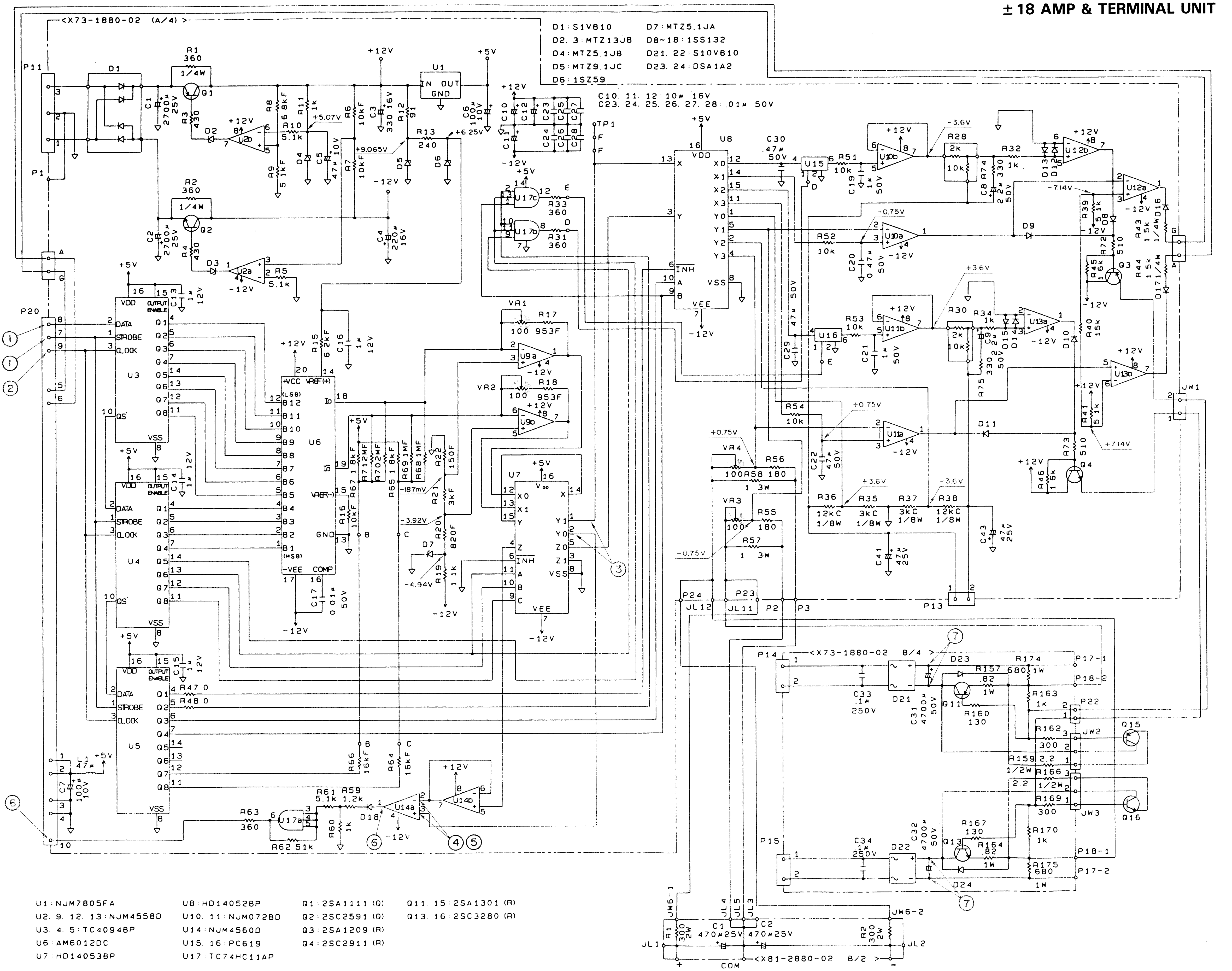
U102-6 Waveform (for K102 disturbance)

During OUTPUT is OFF

3V/diV, 5ms/diV

SCHEMATIC DIAGRAM

±18 AMP & TERMINAL UNIT


<X73-1880-02 (A/4)>
P11
P1
D1
R1 360 1/4W
Q1
R2 360 1/4W
Q2
C1 2700μ 25V
C2 2700μ 25V
R3 430
R4 430
U1
IN OUT
GND
+12V
+5V
-12V
U2a
U2b
R5 5.1k
R8 6.8kF
R9 5.1kF
R10 5.1k
R11 1k
+5.07V
R6 10kF
R7 10kF
C3 330 16V
C4 220μ 16V
C5 47μ 10V
C6 100μ 10V
R12 91
R13 240
+9.065V
+6.25V
TP1
F
C10
C11
C12
C23
C24
C25
C26
C27
C28
P20
DATA
STROBE
CLOCK
OUTPUT ENABLE
VDD
VSS
QS'
U3
U4
U5
C13 1μ 12V
C14 1μ 12V
C15 1μ 12V
R47 0
R48 0
U6
+VCC
VREF(+)
VREF(-)
Io
GND
COMP
-VEE
B1 (MSB)
B12 (LSB)
R15 6.2kF
C16 1μ 12V
C17 0.01μ 50V
R16 10kF
R67 1.8kF
R71 2MF
R70 2MF
R65 1.8kF
R69 1MF
R68 1MF
R22 150F
R21 3kF
R20 820F
R19 1k
D7
-187mV
-3.92V
-4.94V
VR1
VR2
R17 100 953F
R18 100 953F
U9a
U9b
U17a
U17c
U17d
R33 360
R31 360
U7
U8
X0 X1 X2 X3
Y0 Y1 Y2 Y3
INH
VEE
C30 .47μ 50V
U15
U16
R51 10k
R52 10k
R53 10k
R54 10k
C19 1μ 50V
C20 0.47μ 50V
C21 1μ 50V
C22 .47μ 50V
C29 .47μ 50V
U10a
U10b
U11a
U11b
U12a
U12b
U13a
U13b
U14a
U14b
R28 2k 10k
R30 2k 10k
R32 1k
R34 1k
R74 330
R75 330
C8 2.2μ 50V
C9 2.2μ 50V
D8 D9 D10 D11 D12 D13 D14 D15 D16 D17 D18
R39 5.1k
R40 15k
R41 5.1k
R43 1.5k 1/4W
R44 1.5k 1/4W
R45 16k
R46 16k
R72 510
R73 510
Q3
Q4
-3.6V
+3.6V
-0.75V
+0.75V
-7.14V
+7.14V
VR3
VR4
R55 180
R56 180
R57 1 3W
R58 1 3W
R35 3kC 1/8W
R36 12kC 1/8W
R37 3kC 1/8W
R38 12kC 1/8W
C41 47μ 25V
C43 47μ 25V
JW1
P13
P24
P23
JL12
JL11
P2
P3
R63 360
R62 51k
R61 5.1k
R59 1.2k
R60 1k
R66 16kF
R64 16kF
L1 47μ
C7 100μ 10V
P14
P15
<X73-1880-02 B/4 >
C33 .1μ 250V
C34 .1μ 250V
D21
D22
D23
D24
C31 4700μ 50V
C32 4700μ 50V
Q11
Q13
Q15
Q16
R157 .82 1W
R164 .82 1W
R174 680 1W
R175 680 1W
R163 1k
R170 1k
R160 130
R167 130
R162 300
R169 300
R159 2.2 1/2W
R166 2.2 1/2W
P17-1
P18-2
P18-1
P17-2
P22
JW2
JW3
JW6-1
JW6-2
JL1
JL2
JL3
JL4
JL5
R1 300 2W
R2 300 2W
C1 470μ 25V
C2 470μ 25V
<X81-2880-02 B/2 >
+
COM
-
①
②
③
④
⑤
⑥
⑦

D1 : S1VB10
D2. 3 : MTZ13JB
D4 : MTZ5.1JB
D5 : MTZ9.1JC
D6 : 1SZ59
D7 : MTZ5.1JA
D8~18 : 1SS132
D21. 22 : S10VB10
D23. 24 : DSA1A2

C10. 11. 12 : 10μ 16V
C23. 24. 25. 26. 27. 28 : .01μ 50V

U1 : NJM7805FA
U2. 9. 12. 13 : NJM4558D
U3. 4. 5 : TC4094BP
U6 : AM6012DC
U7 : HD14053BP

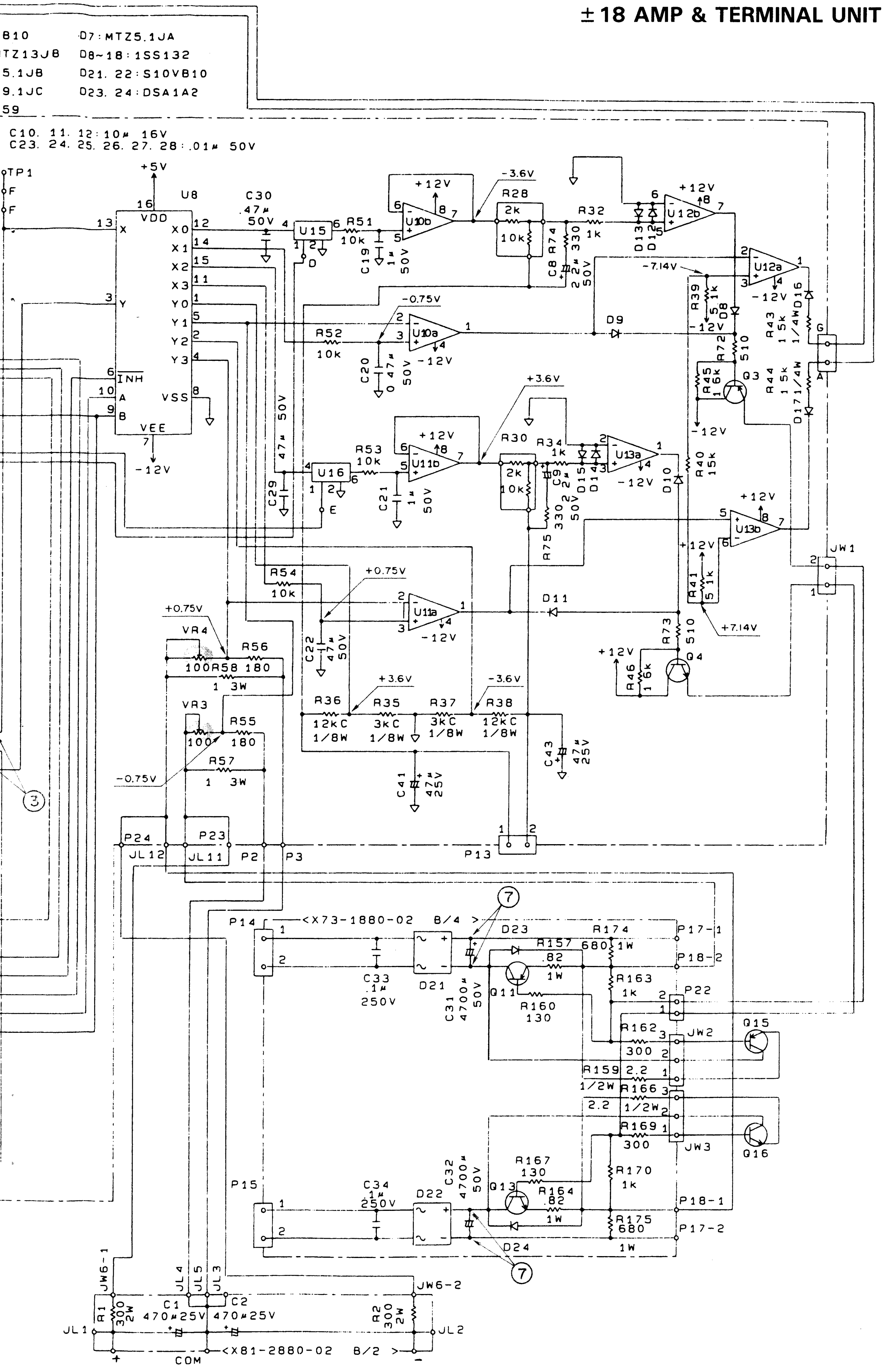
U8 : HD14052BP
U10. 11 : NJM072BD
U14 : NJM4560D
U15. 16 : PC619
U17 : TC74HC11AP

Q1 : 2SA1111 (Q)
Q2 : 2SC2591 (Q)
Q3 : 2SA1209 (R)
Q4 : 2SC2911 (R)

Q11. 15 : 2SA1301 (R)
Q13. 16 : 2SC3280 (R)

GRAM

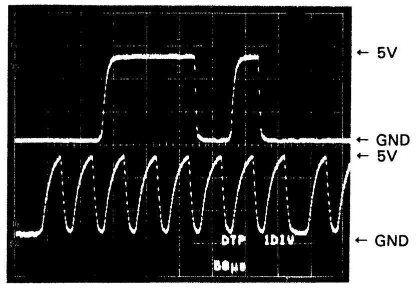
± 18 AMP & TERMINAL UNIT



B10
TZ13JB
5.1JB
9.1JC
59
D7: MTZ5.1JA
D8~18: 1SS132
D21. 22: S10VB10
D23. 24: DSA1A2
C10. 11. 12: 10µ 16V
C23. 24. 25. 26. 27. 28: .01µ 50V
TP1
+5V
U8
VDD
VSS
VEE
INH
C30 .47µ 50V
U15
U16
U10a
U10b
U11a
U11b
U12a
U12b
U13a
U13b
Q3
Q4
Q11
Q13
Q15
Q16
+12V
-12V
-3.6V
+3.6V
-0.75V
+0.75V
-7.14V
+7.14V
VR3
VR4
JW1
JW2
JW3
P2
P3
P13
P14
P15
P17-1
P17-2
P18-1
P18-2
P22
P23
P24
JL1
JL2
JL11
JL12
JW6-1
JW6-2
<X73-1880-02 8/4 >
<X81-2880-02 8/2 >
C31 4700µ 50V
C32 4700µ 50V
C33 .1µ 250V
C34 .1µ 250V
C1 470µ 25V
C2 470µ 25V
R1 300 2W
R2 300 2W
+
COM
-
③
⑦

WAVEFORM

①

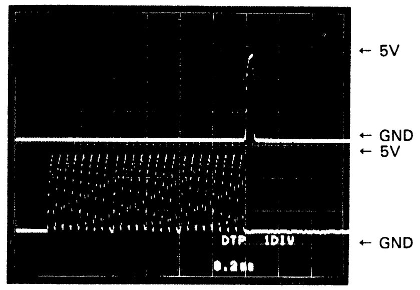


P20-8 Waveform
Since it is DATA waveform, it does not always take this waveform.

P20-7 Waveform
STROBE Waveform
It sends data sent in serial forms into U3, and performs data shift.

50µs/diV

②

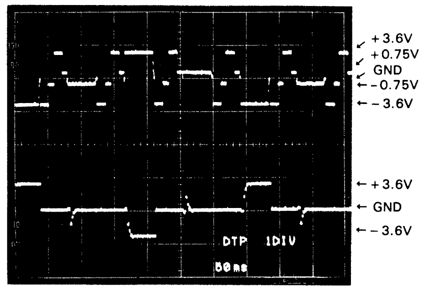


P20-9 Waveform
CLOCK Waveform
It outputs data sent in serial forms from U3 and 4 as parallel data.

P20-7 Waveform
STROBE Waveform
Since volume of data is 24 (3 × 8), one set of this waveform consist of 24 pulses.

0.2ms/diV

③



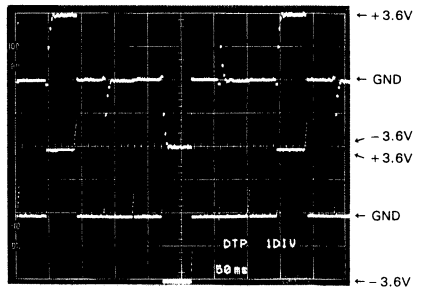
U7-1 Waveform

OUTPUT is ON.
Set-up voltage: Rating
Set-up current: Rating
Load: No load

U7-2 Waveform

50ms/diV

④



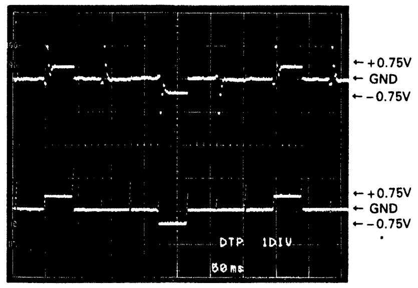
U14-3 Waveform

OUTPUT is ON.
Output voltage: Rating
Output current: 0A

U14-2 Waveform

50ms/diV

⑤



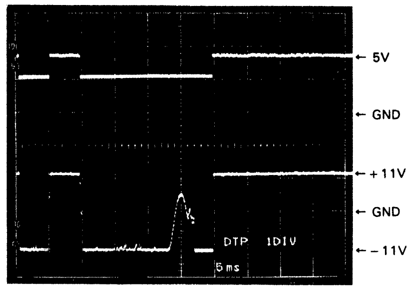
U14-3 Waveform

OUTPUT is ON.
Output terminal: Short-circuit
Output current: Rating

U14-2 Waveform

50ms/diV

⑥



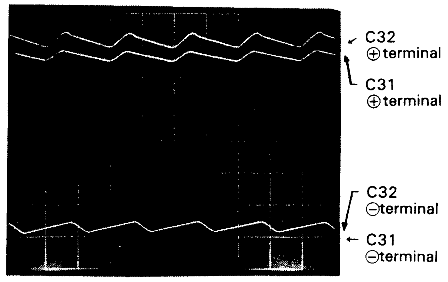
P20-10 Waveform

Since this waveform is compared by a comparater on a serial manner, it does not always take this waveform.

U14-1 Waveform

5ms/diV

⑦

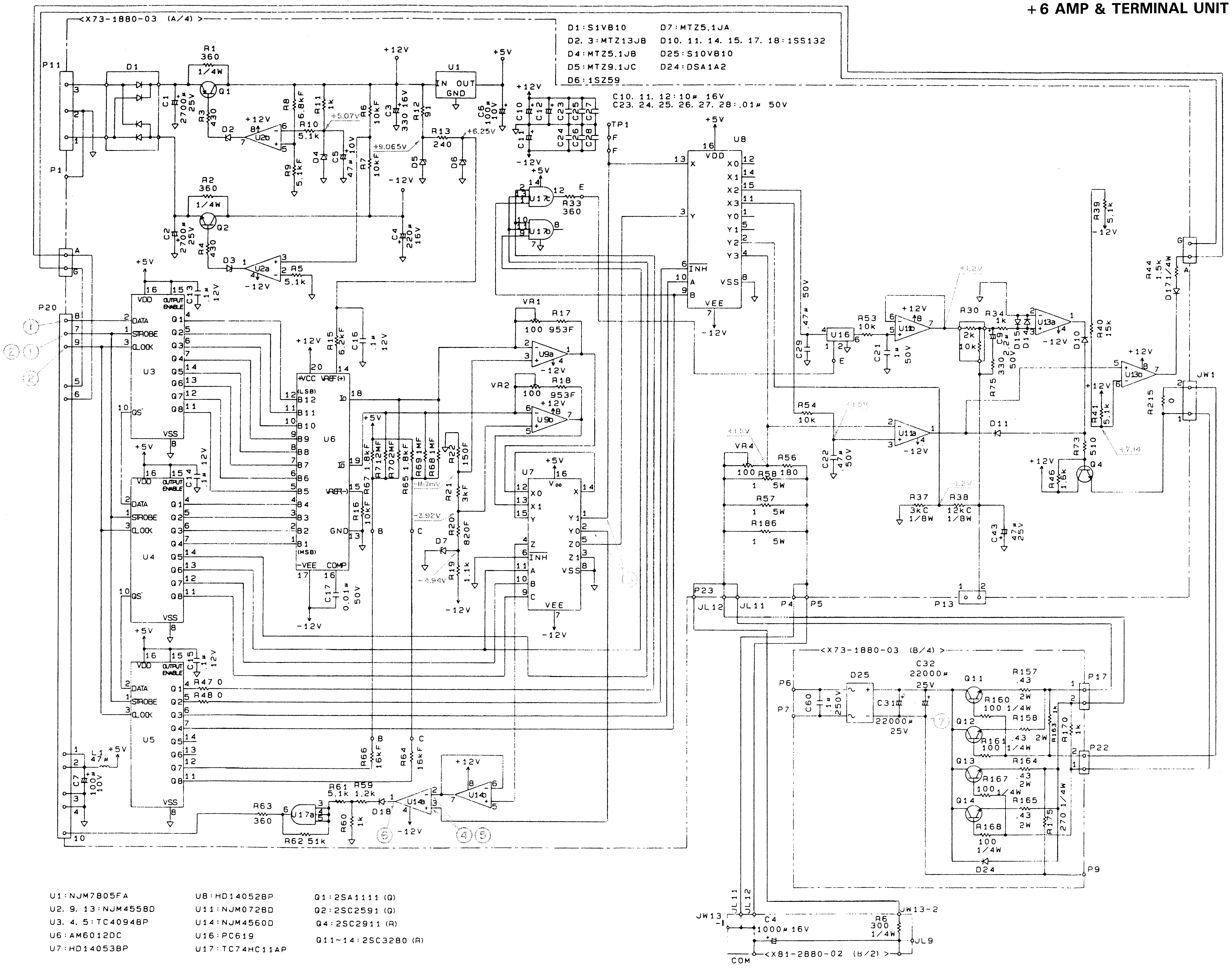


Input AC100 V
Output current
±1 A

2 V/diV, 5ms/diV

SCHEMATIC DIAGRAM

+6 AMP & TERMINAL UNIT



D1:S1VB10　D7:MTZ5.1JA
D2, 3:MTZ13JB　D10, 11, 14, 15, 17, 18:1SS132
D4:MTZ5.1JB　D25:S10VB10
D5:MTZ9.1JC　D24:DSA1A2
D6:1SZ59

C10, 11, 12:10μ 16V
C23, 24, 25, 26, 27, 28:.01μ 50V

U1:NJM7805FA
U2, 9, 13:NJM4558D
U3, 4, 5:TC4094BP
U6:AM6012DC
U7:HD14053BP

U8:HD14052BP
U11:NJM072BD
U14:NJM4560D
U16:PC619
U17:TC74HC11AP

Q1:2SA1111 (Q)
Q2:2SC2591 (Q)
Q4:2SC2911 (R)
Q11~14:2SC3280 (R)

<X73-1880-03 (A/4)>
<X73-1880-03 (B/4)>
<X81-2880-02 (B/2)>
P11
P1
P20
P23
P4
P5
P6
P7
P9
P13
P17
P22
JW1
JW13
JW13-2
JL9
JL11
JL12
COM
TP1
R1 360 1/4W
R2 360 1/4W
R3 430
R4 430
R5 5.1k
R6 10kF
R7 10kF
R8 6.8kF
R9 5.1kF
R10 5.1k
R11 1k
R12 91
R13 240
C1 2700μ 25V
C2 2700μ 25V
C3 330 16V
C4 220μ 16V
C5 47μ 10V
C6 100μ 10V
+5.07V
+9.065V
+6.25V
+12V
-12V
+5V
U1 IN OUT GND
U2a
U2b
U3
U4
U5
U6
U7
U8
U9a
U9b
U11a
U11b
U13a
U13b
U14a
U14b
U16
U17a
U17b
U17c
U17d
DATA
STROBE
CLOCK
VDD
VSS
VEE
OUTPUT ENABLE
QS'
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
+VCC VREF(+)
(LSB) B12
B11
B10
B9
B8
B7
B6
B5
B4
B3
B2
B1 (MSB)
Io
Īo
VREF(-)
GND
-VEE COMP
R15 6.2kF
C16 .1μ 12V
C17 0.01μ 50V
VR1
R17 100 953F
VR2
R18 100 953F
R16 10kF
R67 1.8kF
R71 2MF
R70 2MF
R65 1.8kF
R69 1MF
R68 1MF
R22 150F
R21 3kF
R20 820F
R19 1.1k
D7
-167mV
-3.92V
-4.94V
R33 360
E
X0
X1
X2
X3
Y0
Y1
Y2
Y3
INH
A
B
C
X
Y
Z
Z0
Z1
Y1
Y0
R47 0
R48 0
R63 360
R61 5.1k
R59 1.2k
R60 1k
R62 51k
D18
R66 16kF
R64 16kF
L1 47μ
C7 100μ 10V
C13 .1μ 12V
C14 .1μ 12V
C15 .1μ 12V
C29 .47μ 50V
R53 10k
C21 1μ 50V
R30 2k 10k
R34 1k
C9 2μ 50V
R75 330
D15
D14
D10
R39 5.1k
R40 15k
R44 1.5k
D17 1/4W
R41 5.1k
R215 0
R54 10k
C22 4.7μ 50V
+1.5V
-1.2V
+7.1V
VR4
R56 180
R58 1 5W
R57 1 5W
R186 1 5W
D11
R73 510
R46 1.6k
Q4
R37 3kC 1/8W
R38 12kC 1/8W
C43 47μ 25V
D25
C60 1μ 250V
C31
C32 22000μ 25V
22000μ 25V
Q11
Q12
Q13
Q14
R157 .43 2W
R158 .43 2W
R160 100 1/4W
R161 100 1/4W
R163 1k
R164 .43 2W
R165 .43 2W
R167 100 1/4W
R168 100 1/4W
R170 1k
R175 270 1/4W
D24
C4 1000μ 16V
R6 300 1/4W
①
②
④
⑤
⑥
⑦

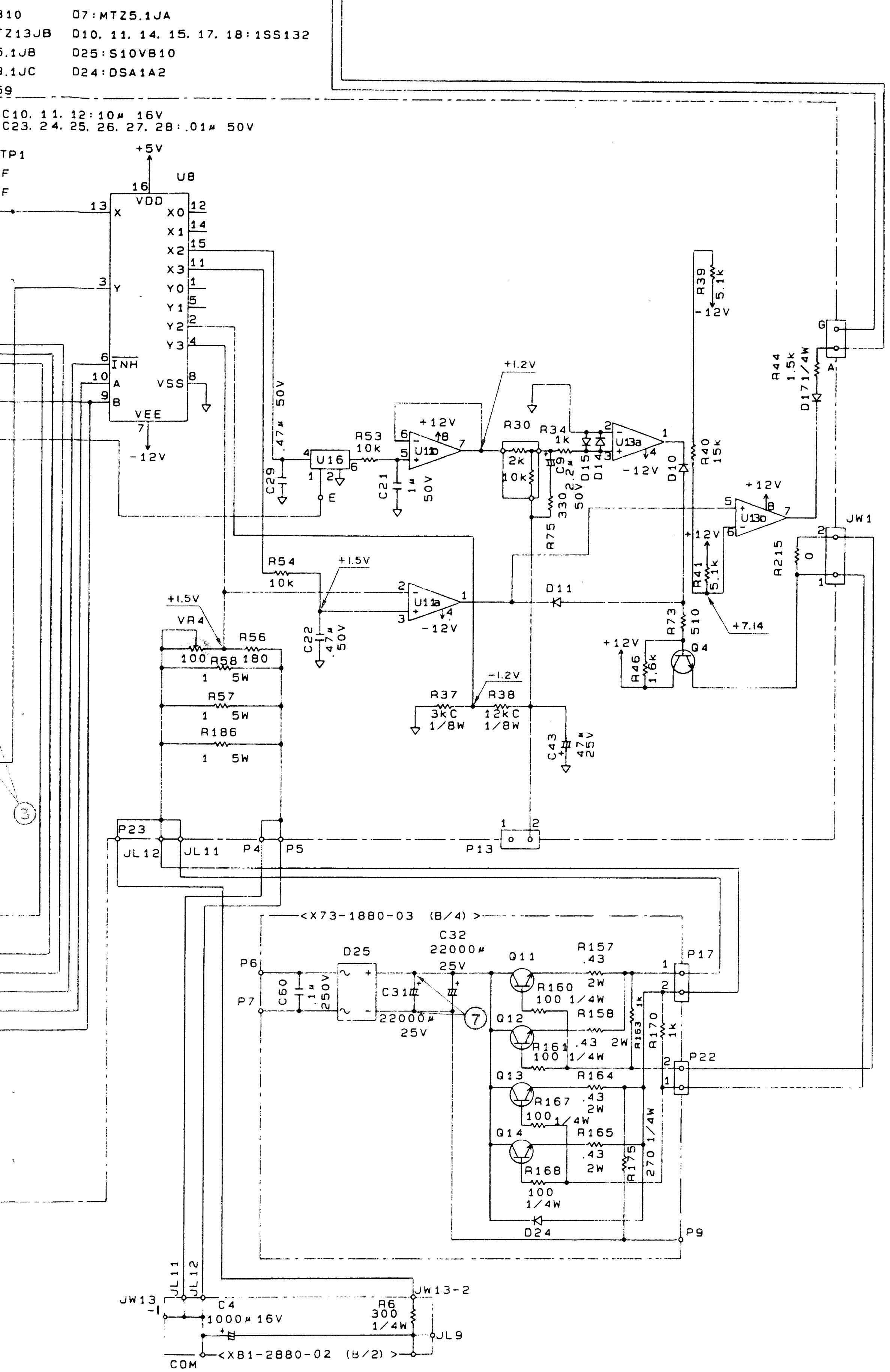
①

②

③

④

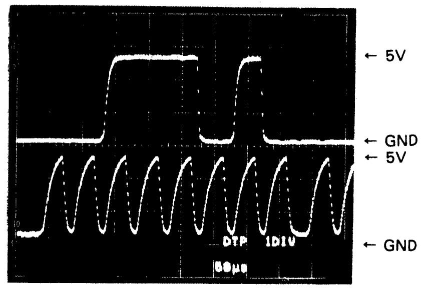
+6 AMP & TERMINAL UNIT



310 D7:MTZ5.1JA
Z13JB D10, 11, 14, 15, 17, 18:1SS132
.1JB D25:S10VB10
.1JC D24:DSA1A2
59
C10, 11, 12:10µ 16V
C23, 24, 25, 26, 27, 28: .01µ 50V
TP1
+5V
U8
VDD
VSS
VEE
INH
-12V
U16
U11b
U11a
U13a
U13b
R53 10k
R30 2k
R34 1k
R39 5.1k
R40 15k
R41 5.1k
R44 1.5k
R46 1.6k
R54 10k
R56 180
R57 1 5W
R58 1 5W
R186 1 5W
VR4 100
R37 3kC 1/8W
R38 12kC 1/8W
R73 510
R75 330
R215 0
C21 1µ 50V
C22 4.7µ 50V
C29 .47µ 50V
C43 47µ 25V
D10
D11
D14
D15
D17 1/4W
Q4
+1.2V
+1.5V
-1.2V
+7.14
+12V
JW1
P23
JL12
JL11
P4
P5
P13
P6
P7
P17
P22
P9
<X73-1880-03 (B/4)>
C32 22000µ 25V
C31 22000µ 25V
C60 .1µ 250V
D25
D24
Q11
Q12
Q13
Q14
R157 .43 2W
R158 .43 2W
R160 100 1/4W
R161 100 1/4W
R163 1k
R164 .43 2W
R165 .43 2W
R167 100 1/4W
R168 100 1/4W
R170 1k
R175 270 1/4W
⑦
③
JW13 -1
JW13-2
C4 1000µ 16V
R6 300 1/4W
JL9
COM
<X81-2880-02 (B/2)>

WAVEFORM

①

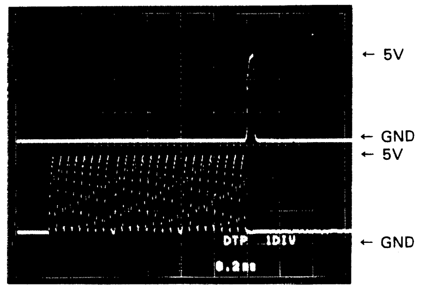


50µs/diV

P20-8 Waveform
Since it is DATA waveform, it does not always take this waveform.

P20-7 Waveform
STROBE Waveform
It sends data sent in serial forms into U3, and performs data shift.

②

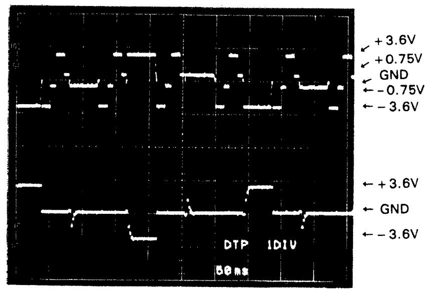


0.2ms/diV

P20-9 Waveform
CLOCK Waveform
It outputs data sent in serial forms from U3 and 4 as parallel data.

P20-7 Waveform
STROBE Waveform
Since volume of data is 24 (3×8), one set of this waveform consist of 24 pulses.

③



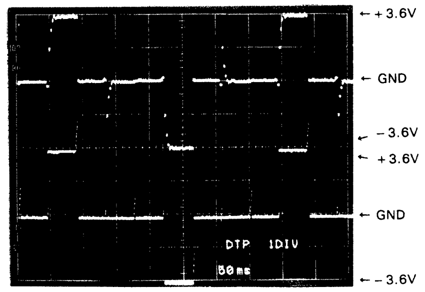
50ms/diV

U7-1 Waveform

OUTPUT is ON.
Set-up voltage: Rating
Set-up current: Rating
Load: No load

U7-2 Waveform

④



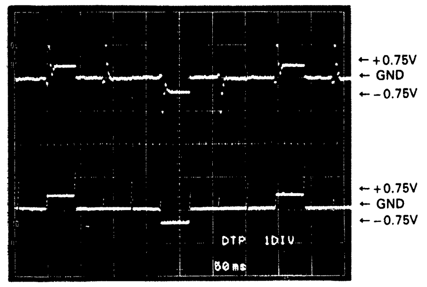
50ms/diV

U14-3 Waveform

OUTPUT is ON.
Output voltage: Rating
Output current: 0A

U14-2 Waveform

⑤



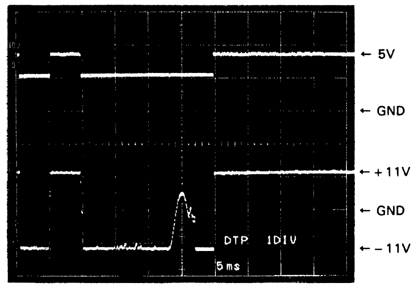
50ms/diV

U14-3 Waveform

OUTPUT is ON.
Output terminal: Short-circuit
Output current: Rating

U14-2 Waveform

⑥



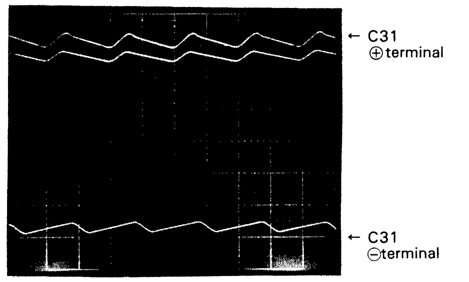
5ms/diV

P20-10 Waveform

Since this waveform is compared by a comparater on a serial manner, it does not always take this waveform.

U14-1 Waveform

⑦



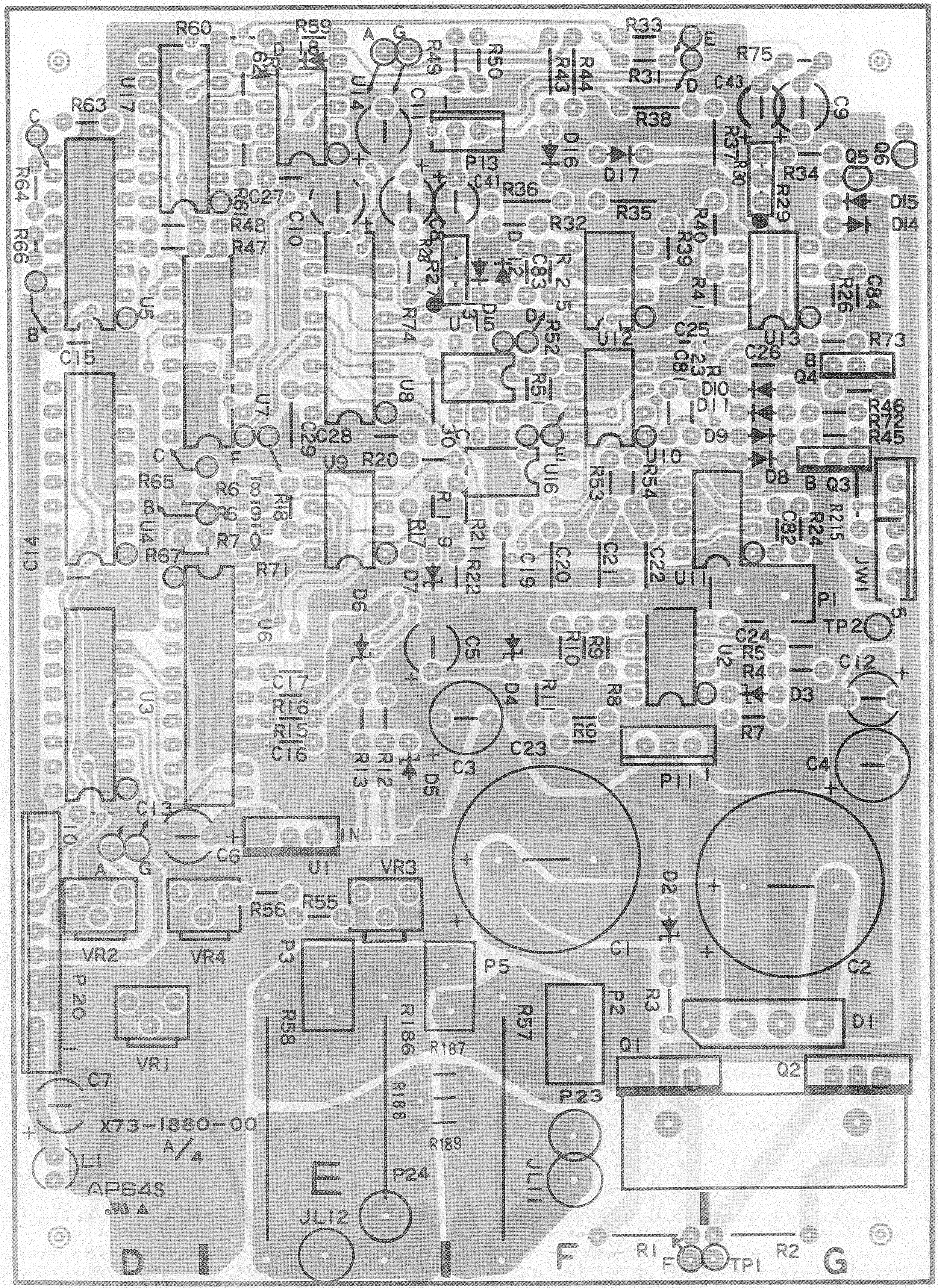
2 V/diV, 5ms/diV

Input AC100 V
Output current
5 A

P.C. BOARD

AMP UNIT (A/4)

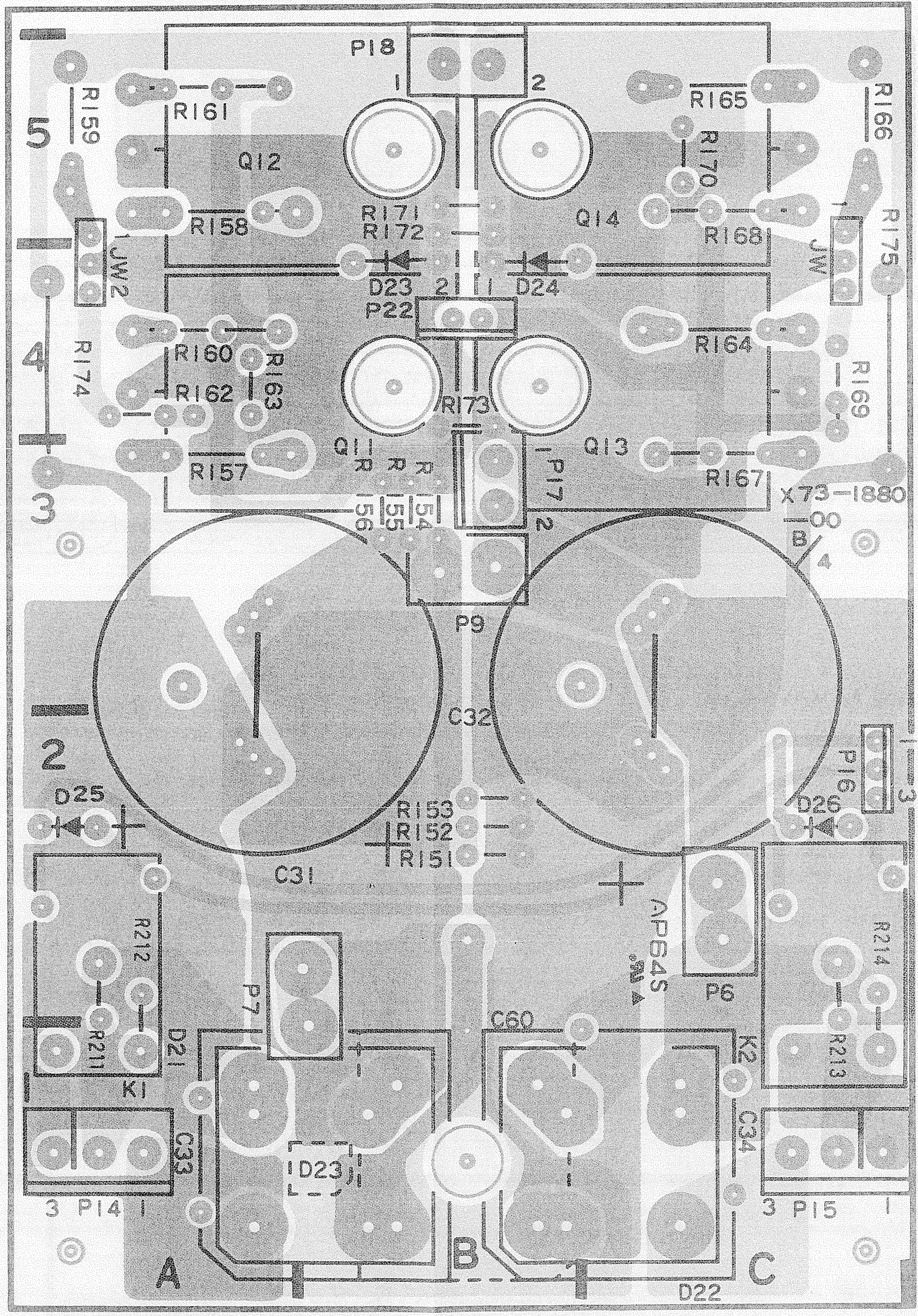
Parts side view



R60
R59
R62
A
G
R49
R50
R33
E
R75
R43
R44
R31
D
C43
C9
U17
R63
C
U14
C11
R38
R37
R30
Q5
Q6
R64
P13
D16
D17
R34
D15
D14
R66
R61
C27
C41
R36
R29
R48
C10
C8
R32
R35
R40
R47
R28
R27
D13
C83
R25
R39
C84
R26
U5
R14
U13
U12
R41
B
C15
R52
C25
C26
R73
R23
R51
C81
R22
D10
Q4
D11
R46
R72
R45
U7
U8
D9
C29
C28
U9
R20
C30
U16
R53
R54
U10
D8
B
Q3
R65
R6
R18
R19
R215
R24
C82
U4
R17
R21
R22
C19
C20
C21
C22
U11
JW1
C14
R67
R7
R71
D7
D6
P1
TP2
U6
C5
R10
R9
U2
C24
R5
C17
R4
C12
R16
D4
R11
R8
D3
R15
C16
R13
R12
D5
R6
R7
C3
C23
C4
U3
P11
C13
C6
U1
IN
A
G
VR3
R56
R55
D2
VR2
VR4
P3
C1
P5
C2
R58
R186
R57
P2
R3
D1
P20
R187
Q1
Q2
VR1
R188
P23
C7
X73-1880-00
A/4
R189
L1
JL11
AP64S
E
P24
JL12
R1
R2
D
F
TP1
F
G

AMP UNIT (B/4)

Parts side view

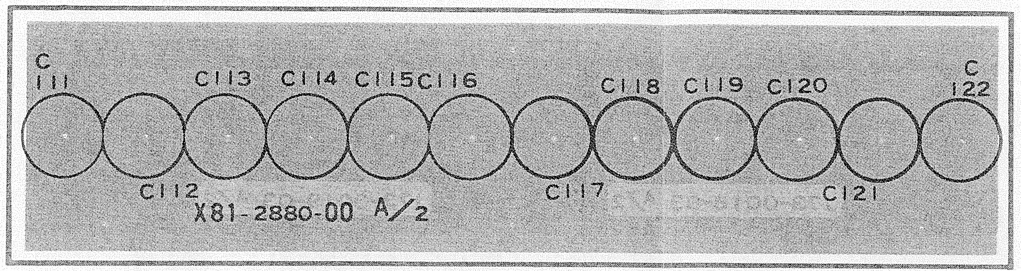


P18
1
2
R161
R165
R166
R159
5
Q12
R170
R171
R172
Q14
R158
R168
R175
JW2
JW
D23
D24
P22
4
R160
R164
R174
R163
R169
R162
R173
Q11
Q13
R157
R156
R155
R154
P17
R167
X73-1880-00
B/4
3
P9
C32
2
P16
D25
D26
R153
R152
R151
C31
AP64S
R212
R214
P7
P6
R211
D21
C60
R213
K1
K2
C33
C34
D23
3 P14 1
3 P15 1
A
B
C
D22

P.C. BOARD

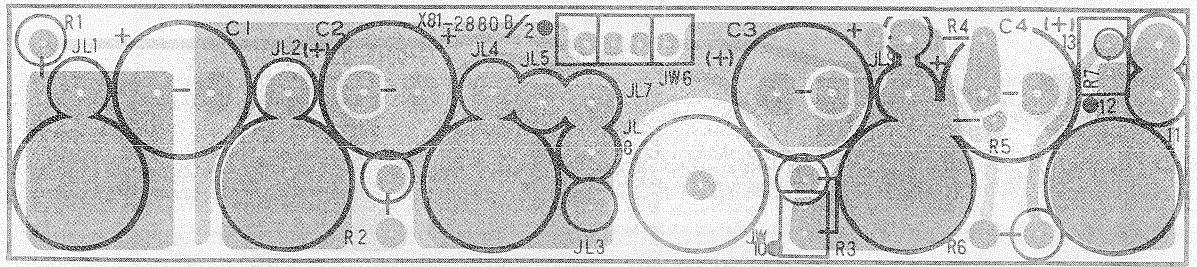
TERMINAL UNIT (A/2)

Parts side view


C111
C112
C113
C114
C115
C116
C117
C118
C119
C120
C121
C122
X81-2880-00 A/2

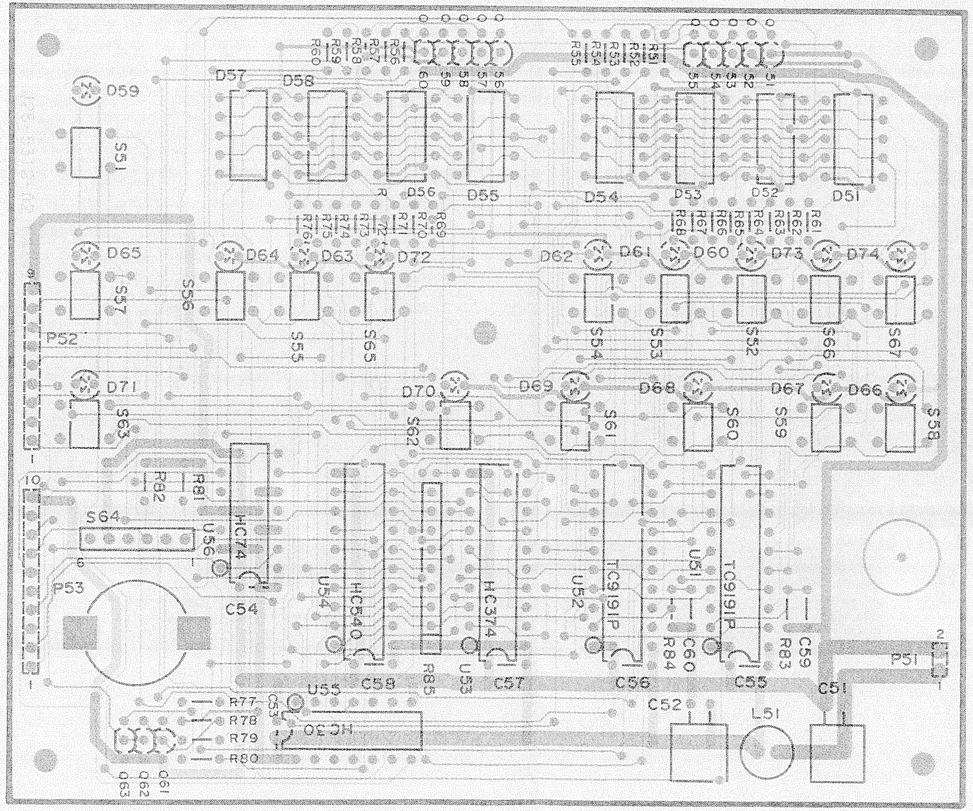
TERMINAL UNIT (B/2)

Parts side view


X81-2880 B/2
R1
JL1
C1
C2
JL2
JL4
JL5
JW6
JL7
JL3
C3
C4
R2
R3
R4
R5
R6
R7
JL8

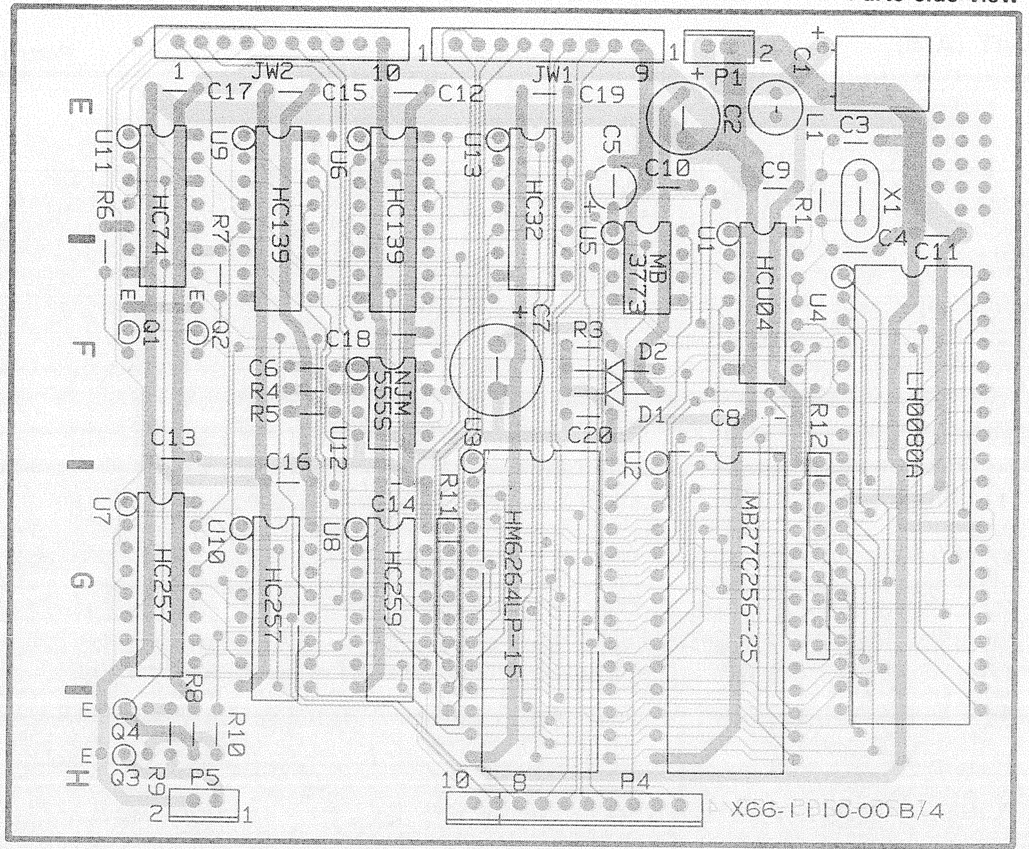
PANEL UNIT (A/4)

Pattern side view


D59
S51
D57
D58
D56
D55
D54
D53
D52
D51
D65
D64
D63
D72
D62
D61
D60
D73
D74
S57
S56
S55
S65
S54
S53
S52
S66
S67
P52
D71
D70
D69
D68
D67
D66
S63
S62
S61
S60
S59
S58
S64
U56
HC74
U54
HC540
HC374
U52
TC9191P
U51
TC9191P
P53
C54
U55
C58
R85
U53
C57
C56
C55
C60
R84
C59
R83
C51
P51
C52
L51
R77
R78
R79
R80
Q61
Q62
Q63

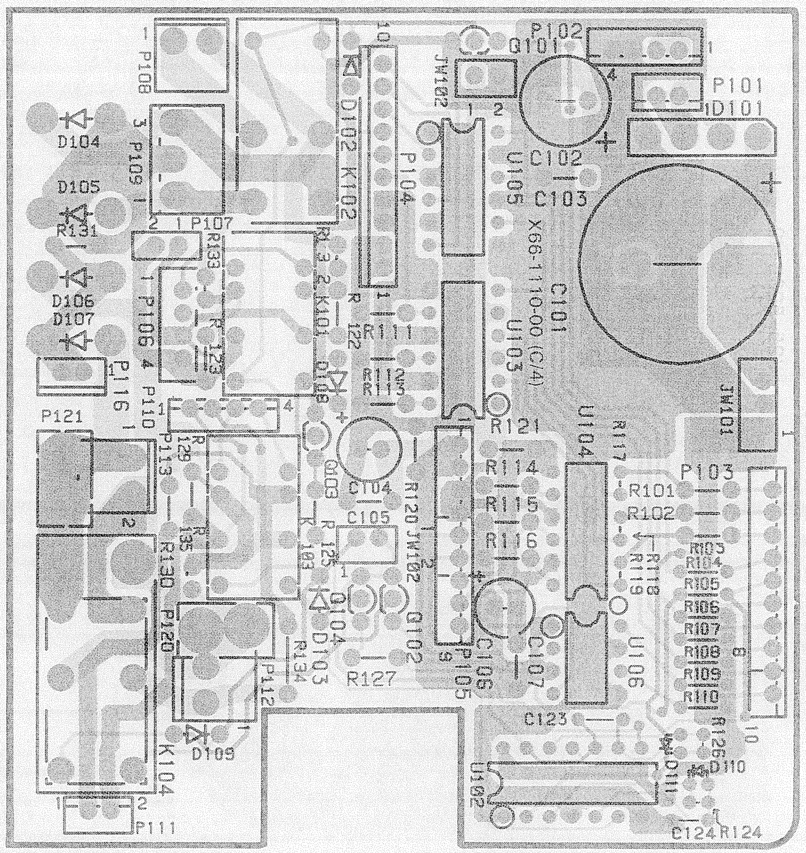
PANEL UNIT (B/4)

Parts side view

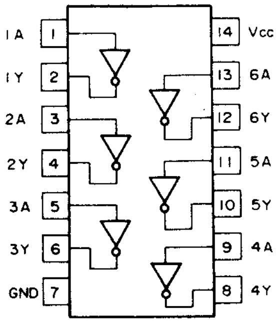

JW2
C17
C15
C12
JW1
C19
P1
C1
C2
L1
C3
U11
R6
U9
HC74
HC139
U6
HC139
U13
HC32
C5
U5
C10
MB 3773
C9
R1
X1
C4
C11
HCU04
U4
U1
R7
Q1
Q2
C18
C6
R4
R5
NJM 555S
U12
C7
R3
D2
D1
C8
R12
LH0080A
C20
U3
U2
C13
C16
C14
R11
HM6264LP-15
MB27C256-25
U7
HC257
U10
HC257
U8
HC259
R8
R10
Q4
Q3
R9
P5
P4
E
F
G
H
X66-1110-00 B/4

PANEL UNIT (C/4)

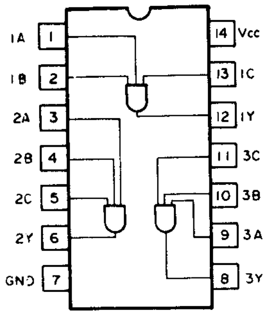
Parts side view


P108
JW102
D102
K102
P102
Q101
P101
D101
D104
P109
P104
U105
C102
C103
D105
R131
P107
R133
R132
K101
X66-1110-00 (C/4)
C101
D106
D107
P106
P110
P116
R123
R122
R111
D108
U103
P121
P113
R129
Q103
C104
R120
C105
R121
R114
R115
R116
U104
R117
JW101
P103
R101
R102
R103
R104
R105
R106
R107
R108
R109
R110
R118
R119
R130
P120
R135
R125
D103
Q104
R134
R127
Q102
P105
C106
C107
U106
P112
D109
K104
C123
R126
D110
U102
D111
P111
C124
R124

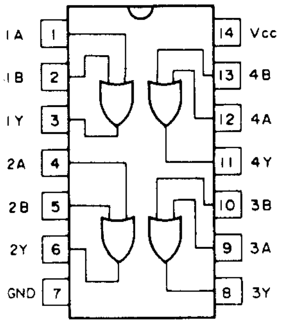
SEMICONDUCTORS


1A 1
1Y 2
2A 3
2Y 4
3A 5
3Y 6
GND 7
14 Vcc
13 6A
12 6Y
11 5A
10 5Y
9 4A
8 4Y

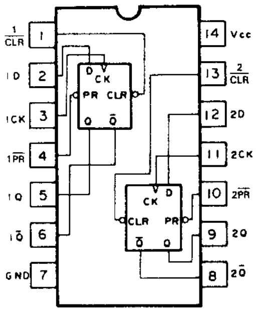
TC74HCU04AP


1A 1
1B 2
2A 3
2B 4
2C 5
2Y 6
GND 7
14 Vcc
13 1C
12 1Y
11 3C
10 3B
9 3A
8 3Y

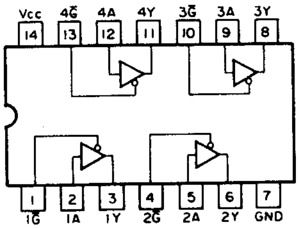
TC74HC11AP


1A 1
1B 2
1Y 3
2A 4
2B 5
2Y 6
GND 7
14 Vcc
13 4B
12 4A
11 4Y
10 3B
9 3A
8 3Y

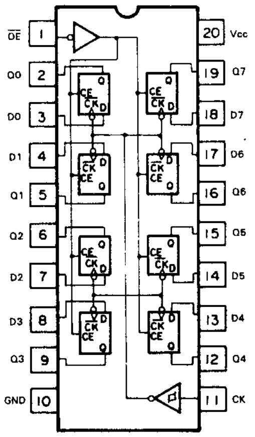
TC74HC32AP


1 CLR 1
1D 2
1CK 3
1PR 4
1Q 5
1Q̄ 6
GND 7
14 Vcc
13 2 CLR
12 2D
11 2CK
10 2PR
9 2Q
8 2Q̄
D
CK
PR
CLR
Q
Q̄

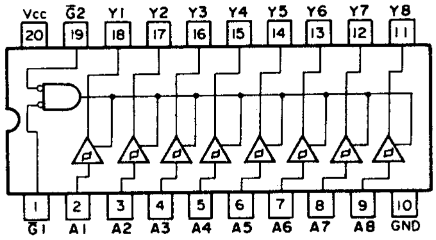
TC74HC74AP


Vcc 14
4G̅ 13
4A 12
4Y 11
3G̅ 10
3A 9
3Y 8
1 1G̅
2 1A
3 1Y
4 2G̅
5 2A
6 2Y
7 GND

TC74HC125AP

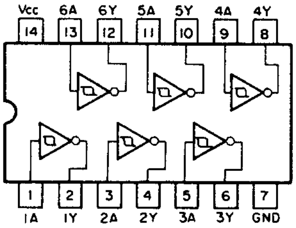

OE 1
Q0 2
D0 3
D1 4
Q1 5
Q2 6
D2 7
D3 8
Q3 9
GND 10
20 Vcc
19 Q7
18 D7
17 D6
16 Q6
15 Q5
14 D5
13 D4
12 Q4
11 CK
CE
CK
D
Q

TC74HC374AP

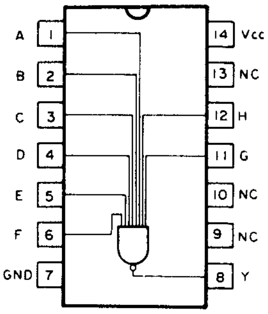

Vcc 20
G̅2 19
Y1 18
Y2 17
Y3 16
Y4 15
Y5 14
Y6 13
Y7 12
Y8 11
1 G̅1
2 A1
3 A2
4 A3
5 A4
6 A5
7 A6
8 A7
9 A8
10 GND

TC74HC541AP

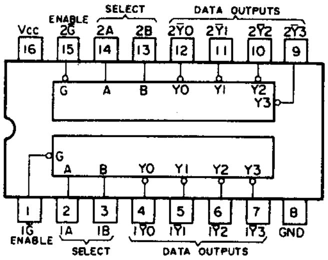
SEMICONDUCTORS


Vcc
6A
6Y
5A
5Y
4A
4Y
14
13
12
11
10
9
8
1
2
3
4
5
6
7
1A
1Y
2A
2Y
3A
3Y
GND

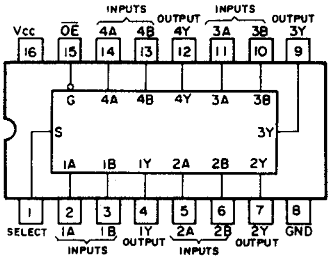
TC74HC14AP


A
B
C
D
E
F
GND
1
2
3
4
5
6
7
14
13
12
11
10
9
8
Vcc
NC
H
G
NC
NC
Y

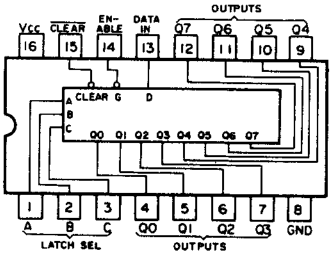
TC74HC30AP


ENABLE
SELECT
DATA OUTPUTS
Vcc
2G
2A
2B
2Y0
2Y1
2Y2
2Y3
16
15
14
13
12
11
10
9
G
A
B
Y0
Y1
Y2
Y3
G
A
B
Y0
Y1
Y2
Y3
1
2
3
4
5
6
7
8
1G
ENABLE
1A
1B
SELECT
1Y0
1Y1
1Y2
1Y3
DATA OUTPUTS
GND

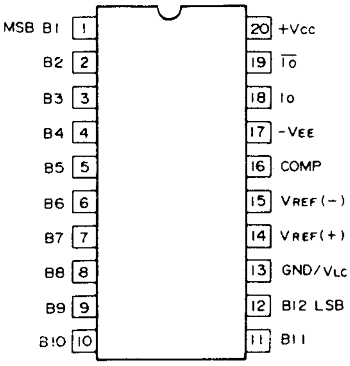
TC74HC139AP


INPUTS
OUTPUT
INPUTS
OUTPUT
Vcc
OE
4A
4B
4Y
3A
3B
3Y
16
15
14
13
12
11
10
9
G
4A
4B
4Y
3A
3B
S
3Y
1A
1B
1Y
2A
2B
2Y
1
2
3
4
5
6
7
8
SELECT
1A
1B
INPUTS
1Y
OUTPUT
2A
2B
INPUTS
2Y
OUTPUT
GND

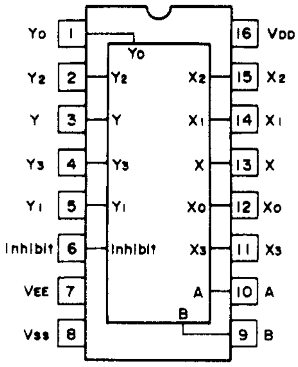
TC74HC257AP


OUTPUTS
Vcc
CLEAR
EN-
ABLE
DATA
IN
Q7
Q6
Q5
Q4
16
15
14
13
12
11
10
9
CLEAR
G
D
A
B
C
Q0
Q1
Q2
Q3
Q4
Q5
Q6
Q7
1
2
3
4
5
6
7
8
A
B
C
LATCH SEL
Q0
Q1
Q2
Q3
OUTPUTS
GND

TC74HC259AP

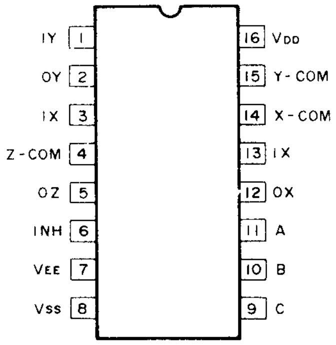

MSB B1
B2
B3
B4
B5
B6
B7
B8
B9
B10
1
2
3
4
5
6
7
8
9
10
20
19
18
17
16
15
14
13
12
11
+Vcc
Io
Io
-VEE
COMP
VREF(-)
VREF(+)
GND/VLC
B12 LSB
B11

AM6012DC


Y0
Y2
Y
Y3
Y1
Inhibit
VEE
VSS
1
2
3
4
5
6
7
8
Y0
Y2
Y
Y3
Y1
Inhibit
X2
X1
X
X0
X3
A
B
16
15
14
13
12
11
10
9
VDD
X2
X1
X
X0
X3
A
B

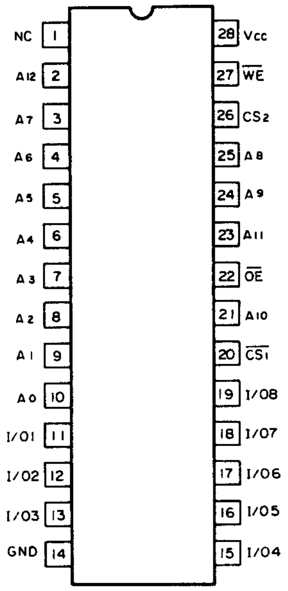
HD14052BP

SEMICONDUCTORS



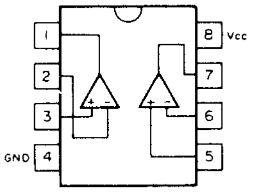
IY 1
OY 2
IX 3
Z-COM 4
OZ 5
INH 6
VEE 7
Vss 8
16 VDD
15 Y-COM
14 X-COM
13 IX
12 OX
11 A
10 B
9 C

HD14053BP



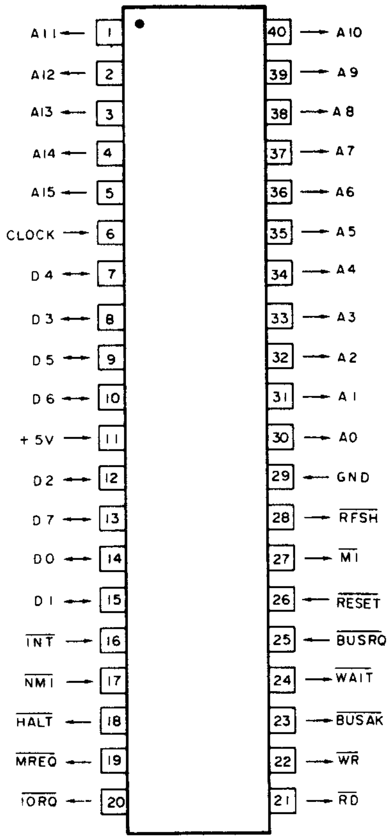
NC 1
A12 2
A7 3
A6 4
A5 5
A4 6
A3 7
A2 8
A1 9
A0 10
I/O1 11
I/O2 12
I/O3 13
GND 14
28 Vcc
27 WE
26 CS2
25 A8
24 A9
23 A11
22 OE
21 A10
20 CS1
19 I/O8
18 I/O7
17 I/O6
16 I/O5
15 I/O4

HM6264ALP-15L

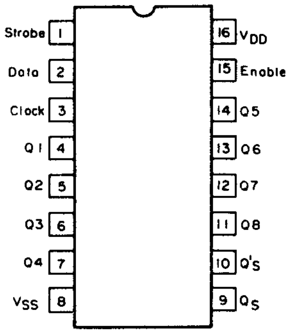


1
2
3
GND 4
8 Vcc
7
6
5
+
-
+
-

NJM4558D



A11 1
A12 2
A13 3
A14 4
A15 5
CLOCK 6
D4 7
D3 8
D5 9
D6 10
+5V 11
D2 12
D7 13
D0 14
D1 15
INT 16
NMI 17
HALT 18
MREQ 19
IORQ 20
40 A10
39 A9
38 A8
37 A7
36 A6
35 A5
34 A4
33 A3
32 A2
31 A1
30 A0
29 GND
28 RFSH
27 M1
26 RESET
25 BUSRQ
24 WAIT
23 BUSAK
22 WR
21 RD

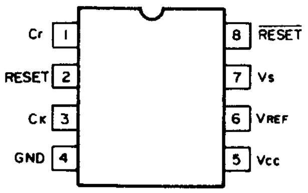


Strobe 1
Data 2
Clock 3
Q1 4
Q2 5
Q3 6
Q4 7
VSS 8
16 VDD
15 Enable
14 Q5
13 Q6
12 Q7
11 Q8
10 Q'S
9 QS

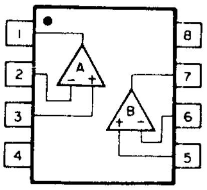
TC4094BP

LH0080A

SEMICONDUCTORS

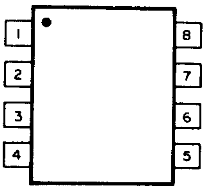

Cr
RESET
Ck
GND
RESET
Vs
VREF
Vcc

MB3773P-G



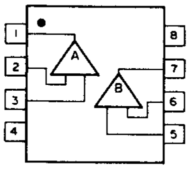
Pin name
1. A OUTPUT
2. A (−) INPUT
3. A (+) INPUT
4. V^-
5. B (+) INPUT
6. B (−) INPUT
7. B OUTPUT
8. V^+

NJM072BD

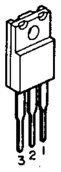


Pin name
1. GND
2. TRIGGER
3. OUTPUT
4. RESET
5. CONTROL VOLTAGE
6. SLESHHOLD
7. DISCHARGE
8. V^+

NJM555D

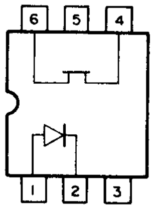


NJM4560D

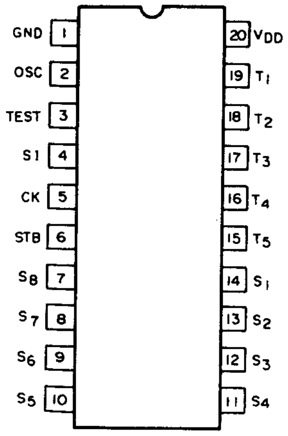


1. OUT
2. GND
3. IN

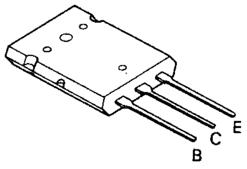
NJM7805FA



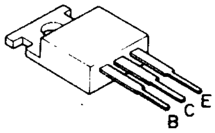
PC619


GND
OSC
TEST
S1
CK
STB
S8
S7
S6
S5
VDD
T1
T2
T3
T4
T5
S1
S2
S3
S4

TC9191P

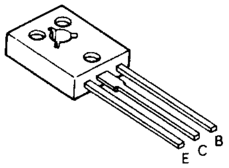


2SA1301 (R)
1302 (R)
2SC3280 (R)
3281 (R)

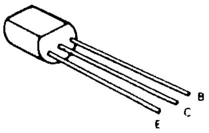


2SA1111 (Q)
2SC2591 (Q)

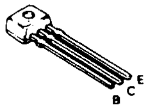
SEMICONDUCTORS



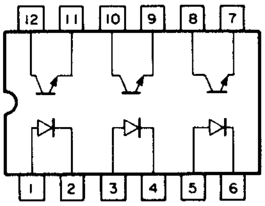
2SA1209 (R)
2SC2911 (R)



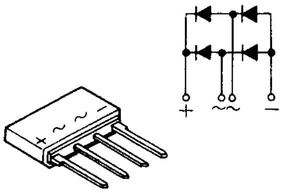
2SC1815 (Y)



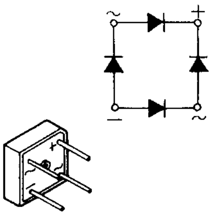
2SC2785 (F)


12
11
10
9
8
7
1
2
3
4
5
6

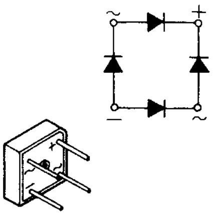
PC837



S1VB10



S4VB20F1



S10VB10
S10VB10F1